

EDIBLE FISHES OF QUEENSLAND.

PART IV.—SYNENTOGNATHI (No. 1).

SUBORDER I.—SCOMBRESOCOIDEA.

By J. DOUGLAS OGILBY (ICHTHYOLOGIST).

(Plates XIV to XXIII.)

“Synentognaths with small scales and with the mouth typically large, the jaws usually produced and narrowed forwards; rami of the lower jaw united by the interlocking of a series of inner processes (except in *Cololabis*); maxillaries firmly united to premaxillaries. Third upper pharyngeals moderately enlarged; fourth usually present; lower pharyngeal triangular or long and narrow. Pharyngeal teeth usually villiform or granular, some of the teeth of the principal plates often compressed, tricuspid. Parasphenoid without apophysis; myodome elongate, the parasphenoid and pro-otic meeting in a long sutural union; auditory bulla, if distinct, little prominent, with but a shallow depression in front of it. Posttemporal more or less expanded and laminar, simple or with a small inner fork; supraeleithrum small, partly or entirely hidden by the posttemporal; cleithrum connected with basioccipital by a strong ligament. Each pelvic bone of an anterior subtriangular lamina and an erect laminar process, which is more or less expanded superiorly.” (*Regan.*)¹

Key to the Scombresocoid Families.

*a*¹. Both jaws produced, furnished with bands of small teeth.

*b*¹. Jaw with an additional series of more or less enlarged erect conical pointed teeth; no finlets i. BELONIDÆ.

*b*². Jaws without enlarged teeth; finlets present SCOMBRESOCOIDEÆ.

FAMILY I.—BELONIDÆ.

Scombresocidæ part. Günther, Brit. Mus. Catal. Fish., vi, 1866, pp. 234-256; Day, Fish. India, pt. 3, 1877, pp. 509-512; Boulenger, Cambridge Nat. Hist., vii, 1904, p. 637.

Mastacembeliformes Bleeker, Atlas Ichth., vi, pt. 2, 1871, p. 43.

Esocidæ Gill, Proc. U. S. Nat. Mus., xviii, 1895, p. 177; Jordan & Evermann, Fish. North & Mid Amer., pt. i, 1896, p. 708.

Belonidæ Jordan and Starks, Proc. U. S. Nat. Mus., xxvi, 1903, p. 526; Regan, Ann. & Mag. Nat. Hist. (8) vii, 1911, p. 331.

“THE NEEDLE-FISHES.”

Body usually much elongated, covered with small flaky scales. Cleft of mouth wide. Both jaws produced to form a stout pointed beak, armed with bands of small sharp teeth and a single series of strong widely set erect conical

¹ Ann. & Mag. Nat. Hist. (8) vii, 1911, p. 331.

teeth; vomerine teeth rarely present. Anterior dorsal and anal rays forming a lobe (except in *Potamorhaphis*); no dorsal or anal finlets. Posttemporal forked, the upper fork more or less expanded, anteriorly attached to the nearly horizontal epiotic and pterotic lamina, the lower fork short and slender, attached to a process of the exoccipital lamina; supracleithrum small, vertical, more or less concealed beneath the posttemporal. Vertebrae 57 to 77; precaudals with strong parapophyses to which the ribs are attached.

Carnivorous synentognaths inhabiting all warm seas; many of the species enter rivers and a few live permanently in fresh water. Six genera, with about 60 species, are now recognized. Of these, two—*Tylosurus* and *Athlenes*—have already been recorded from our waters; species of *Belone* occur from the East Coast of Africa and North-West Australia through the South Sea Islands to Hawaii and can not, therefore, be overlooked; *Xenentodon* rests at present on Macleay's statement² "235. *Belone cancala* Buch. 'Quarrabudda' of the natives. From fresh water [at Port Moresby or Cuppa Cuppa]." I am inclined to doubt the correctness of the identification of this Indo-Burmese fish so far east. Several species of needle-fishes (better known to our fishing community by the vernacular name "long tom") frequent our seas, while others doubtless occur on our northern borders as evidenced by their recorded distribution. They are carnivorous and predacious, feeding at or near the surface, wandering in small companies or singly along the shore, and rarely venturing to any great distance from the land. Like all fishes of similar habits, whose strenuous mode of existence demands great and continuous muscular exertion, they require a large amount of nourishment to replace the loss occasioned by their active life, and sustain in unabated vigor the energy on which such excessive calls are made; it is not surprising, therefore, that we find them extremely swift in movement and insatiable in appetite. They are consequently very destructive to small or young surface-swimming fishes, of which they destroy vast numbers in excess of those which they actually consume. They delight in throwing themselves high into the air, and frequently skim along the surface of the water for a considerable distance with marvelous velocity. Such, indeed, is their reckless impetuosity that, in the case of the larger and weightier species, serious accidents, resulting even in death, have been caused to bathers from the impact of the dagger-like beak on the unprotected body. Their partiality for leaping over any small floating object, which may attract their attention, is another peculiar habit common to these volatile fishes; in some countries this habit is ingeniously made use of for their capture, by the simple means of a wooden framework, which somewhat loosely supports a piece of fine netting. They may also be taken by hook and line from a moving boat in a strong tideway, so long as the lure, for which any small shining object will suffice, is kept near the surface. All the species are of good quality for the table, and though often rejected because of the greenish color of their bones, this is natural and has no deleterious significance. The ova, which are large and consequently few in number, float on the surface when first shed; each ovum, however, is provided with several series of silky filaments, and is enabled, by means of these delicately barbed processes, to attach itself to any suitable object. When the little fish first emerges from the egg both its jaws are short, but they soon begin to lengthen, and it is a remarkable fact that the lower increases so much more rapidly than the upper that, by the

² Proc. Linn. Soc. N. S. Wales, vii, p. 592.

time the fry has attained a length of a couple of inches, it has all the appearance of a hemirhamphid, nor is it until considerably later in life that the beak assumes the normal adult form.

Key to the Genera.

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| <i>a</i> ¹ . Gill-rakers developed | i. BELONE. |
| <i>a</i> ² . Gill-rakers absent or vestigial. | |
| <i>b</i> ¹ . Three pair of upper pharyngeals (2nd, 3rd, and 4th) dentigerous. | |
| <i>c</i> ¹ . Body subterete or but moderately compressed | ii. TYLOSURUS. |
| <i>c</i> ² . Body strongly compressed | iii. ATHLENNES. |
| <i>b</i> ² . One pair only of upper pharyngeals (3rd) dentigerous | iv. XENENTODON. |

ATHLENNES Jordan & Fordice.

Athlennes Jordan & Fordice, Proc. U. S. Nat. Mus., ix, 1886, p. 345 (*hians*); Jordan & Evermann, Bull. U. S. Fish. Comm., xxiii, 1903, p. 125; Regan, Ann. & Mag. Nat. Hist. (8) vii, 1911, p. 332.

Body elongate and strongly compressed, the sides flattened. Jaws slender, the premaxillary elevated proximally; base of mandible very deep. Anterior dorsal rays forming a lobe. No gill-rakers. Second and third upper pharyngeals dentigerous; lower pharyngeal elongate and narrow, the dentigerous plate scarcely expanded.³

Belonids of moderate size from the warmer parts of the Western Atlantic, Pacific, and Indian Oceans. Three perhaps four closely allied forms have been described; some authorities unite them in one species, under the name *Athlennes hians*.

Remarks.:—Some six years ago the late Dr. Albert Gunther⁴ united under one name, *Belone hians*, all the various forms of *Athlennes* known to him. For reasons given below I am not disposed to concur in this view, believing that the typical Western Atlantic species, *A. hians* Valenciennes,⁵ is quite distinct from the North-Western Pacific *A. schismatorhynchus* Bleeker,⁶ from the Eastern Australian *A. caruleofasciatus* Stead, and probably from the Hawaiian form associated with *A. hians* by Jordan and Evermann.⁷ Of the Indo-Ethiopian species, *Belone melanostigma* Valenciennes,⁸ I am not in a position to form a judgment, because of the meagreness of the two descriptions to which I have access, those of Valenciennes and Day⁹ (who makes it synonymous with *schismatorhynchus*); in neither of these descriptions is any mention made of the remarkable compression of the body nor the conspicuous premaxillary ridge, the two dominant characteristics of the species, if it be identical with the Japanese fish and an *Athlennes*. In 1908 Stead, under the name of *Tylosurus caruleofasciatus*, added, from the New South Wales coast, yet another *Athlennes* to the above list; it is with this form, which has recently been obtained in

³ Jordan & Evermann say of this generic title—"This name was inadvertently written '*Athlennes*' by its authors, and as this form has now been several times used it may remain so. *Ablennes* was intended, as the etymology shows; *Athlennes* is meaningless, but euphonious."

⁴ Fische d. Sudsee, p. 353.

⁵ Hist. Nat. Poiss., xviii, p. 432.

⁶ Atlas Ichth., vi, p. 49.

⁷ Bull. U. S. Fish. Comm., xxiii, p. 125.

⁸ Ibid., p.

⁹ Fish. India, p. 510

Moreton Bay, that I am principally concerned. From Valenciennes' original description of the West Atlantic fish our species differs in having—the greatest height of the body situated immediately in advance of the ventral fins, where it is fully one seventh more than at the origin of the anal; a longer beak, ours being two and a third times the rest of the head as against his "not quite twice"; the lower border of the maxillary dilation exposed, even when the jaws are pressed closely together; the greater part of the cephalic groove smooth, nowhere granulose; the thoracic region broadly rounded below, not trenchant; the branchiostegal membrane exposed; fewer dorsal rays. In Jordan and Evermann's description of the same fish¹⁰ the authors state that—the width of the body is "not half of its greatest depth," that the caudal peduncle is "not compressed," that the snout is only "twice the rest of the head," that the maxillary is entirely concealed by the preorbital," and that the insertion of the ventrals is "midway between front of arch of upper jaw and base of caudal." Not one of these characters agrees with our species, which should, therefore, be definitely separated from *A. hians*. These authors, however, refer the Hawaiian form to *A. hians*, but here again discrepancies occur between our descriptions. For instance they write—Head 2.6 (2.1),¹¹ depth 9 (8.4) in trunk; width of head about 2 (1.6) in its depth; eye about 2 (2.25) in post-orbital head; dorsal (and anal) lobe much produced, "equal to head behind the anterior border of nasal depression" (*see figure*) (less produced, only equal to postorbital head), pectoral with 12 (14) rays, its length 3.3 (3.6) in head, ventral a little over 4 (5.1) in head. As regards the Japanese *A. schismatorhynchus*, included by Günther in the synonymy of *A. hians*, the task of differentiation with our species is more difficult, nevertheless valid characters separating them can I think be found. From Jordan and Starks¹² description of *A. schismatorhynchus* our fish differs in its more robust form, its much longer head, longer jaws, longer pectoral, and differently shaped dorsal.

ATHLENNES CÆRULEOFASCIATUS (Stead).

(Plate XIV.)

Tylosurus cæruleofasciatus Stead, New Fish, N. S. Wales, No. 1, Sept. 1908, p. 3, pl. i.

BARRED NEEDLE-FISH.

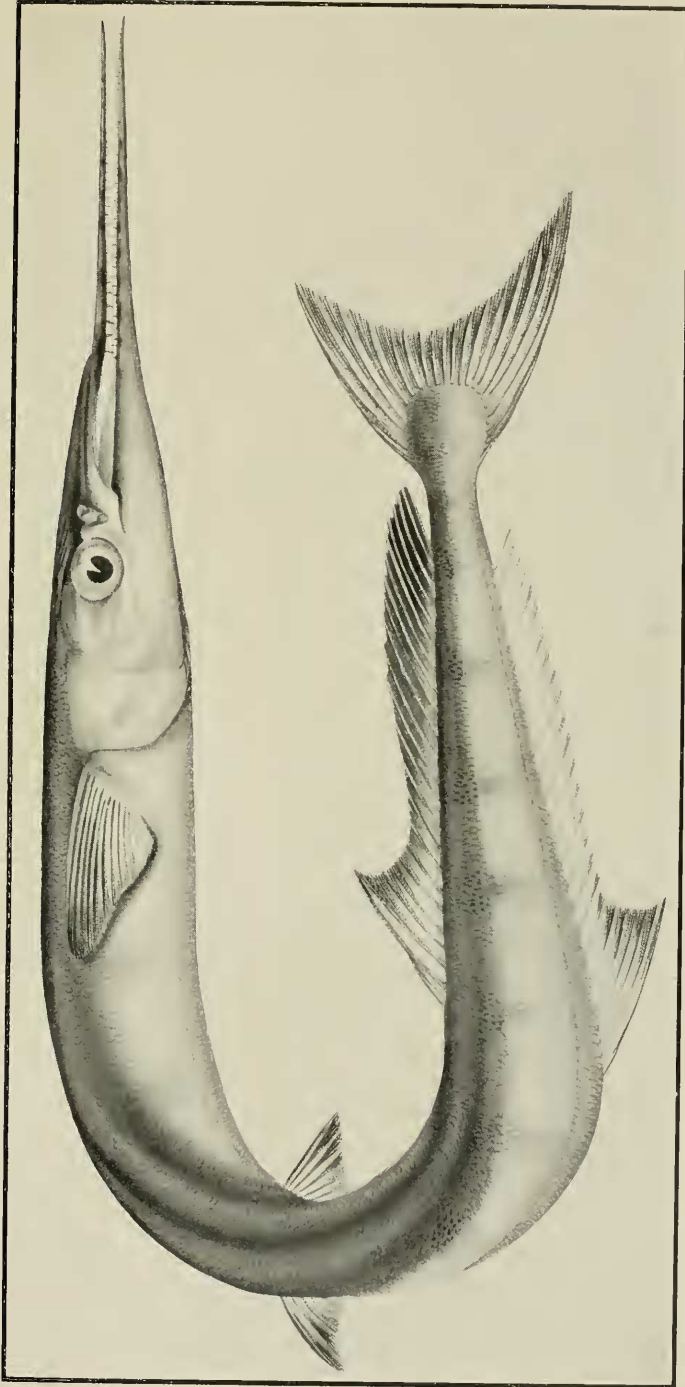
Type locality:—Port Stephens, N.S.W.

Body compressed, its width 1.85 in its depth, which is 14.3 in its length and equal to the head behind the middle of the eye. Caudal peduncle about one eighth deeper than wide immediately behind the dorsal fin, its depth 1.7 in its length and 1.25 in the eye-diameter. Depth of head five eighths more than its width and 5.15 in its length, which is 3.55 in that of the body. Post-orbital length of head 3.4 in the length of the snout, which is 5.05 in the body-length. Jaws long and slender, of nearly equal length, not meeting posteriorly when the mouth is closed. Proximal portion of premaxillary forming an elevated ridge, which terminates in an acute point, its length 2.85 in that of the snout; maxillary not entirely concealed by the preorbital; proximal portion of lower jaw exceedingly deep, its greatest depth 2.33 in the postorbital head. Diameter

¹⁰ Fish, North & Mid. Amer., p. 718.

¹¹ The measurements in brackets belong to *A. cæruleofasciatus*, and are inserted here to facilitate comparison.

¹² Proc. U. S. Nat. Mus., xxvi, p. 528.



Phyllis Clarke, del. *ATHLENNES CAERULEOFASCIATUS (Stead).* $\frac{2}{3}$ Nat. Size.

of eye a little less than the interorbital width and 2.25 in the postorbital head. Upper surface of head with a shallow groove, the borders of which converge anteriorly; supraciliary and supranasal regions striated.

Enlarged teeth short and slender, the series commencing a short distance behind the tip of the premaxillary crest, and rapidly fining down towards the tip, near which they become obsolescent; tongue smooth.

Scales small and adherent; cheeks, upper anterior portion of opercle, parietal region, and anterior part of the cephalic groove scaly. Lateral line extending to the caudal fin, not keeled posteriorly.

Dorsal fin with 23-24 rays, originating above the 6th anal ray, the space between its origin and the caudal fin equal to the length of the snout; 2nd ray longest, as long as the postorbital head and two and two thirds times the length of the 7th and shortest ray, beyond which they increase gradually to the 15th, which is about one sixth less than the 2nd; last ray not produced, not quite extending to the caudal. Caudal fin emarginate, the middle rays 2.25 in the lower lobe, which is half as long as the snout. Anal fin with 26 or 27 rays, as long as the snout, terminating a little in advance of the end of the dorsal; 2nd ray longest, one sixth higher than the dorsal lobe, and as long as the head behind the middle of the eye; last ray short, extending rather more than half way to the base of the caudal. Pectoral pointed, with 14 rays, as long as the head without the snout, and 12.5 in the length of the body. Ventral originating about one eighth nearer to the eye than to the root of the caudal, its length equal to the postorbital head.

Distance of vent from anal 3.33 in that from the origin of the ventral.

Back with a narrow dark-green vertebral stripe from the occiput to the dorsal fin; below this is a broad sea-green band extending to the tail; below this again is an equally broad plumbeous band, which throws off about 13 rather obscure vertical shoots into the pearly white of the sides and lower surface. Upper edge of opercle, hinder border of preopercle, upper eye, preorbital, and premaxillary crest black. Dorsal fin posteriorly sea-green with a blackish border, the posterior produced area uniform black; caudal greenish gray, the bases of the middle rays plumbeous; outer half of anal lobe dusky; upper ray, outer half, and posterior base of pectoral blackish; ventral with a black basal spot and broadly tipped with blackish. (*caruleus*, blue; *fasciatus*, barred.)

Described from a fine specimen, 600 millim. in length, obtained in Moreton Bay, and secured for the Queensland Museum through the acumen of Mr. William G. Beach, Secretary to the Brisbane Fish Market, who recognized it at once as a species of "Long Tom" with which he was unacquainted.

Historical.—Prior to Mr. Beach's discovery of this species in a consignment of fishes sent to the Brisbane Market from Moreton Bay, our only knowledge of it consisted of the account given by Stead in the paper to which reference is made above. He there writes as follows:—"In the month of April, 1904, four specimens of a remarkable Long-Tom, of a species hitherto unknown, were received (through the observation of Dr. James C. Cox, M.D., F.R.C.S.E., Commissioner of Fisheries) from Mr. J. E. Chinnery, fishmonger of this city. From the latter gentleman's evidence, as well as from that of one of the Department's Inspectors, it transpired that they had been captured in the one haul with Garfish (*Hemirhamphus*) at Port Stephens." Only one of Stead's specimens, a fish measuring 470 millim., was perfect.

Uses.—Naturally with a fish which is so scarce in our seas we have no data as to its edible qualities, but there is no reason to believe that it differs in any respect from its congeners, of one of which, the Western Atlantic *A. hians*, we learn from Valenciennes on the authority of Poey that "it is good eating."

Range.—East Coast of Australia. Moreton Bay (*Ogilby*); Port Stephens (*Stead*).

Dimensions.—To at least 600 millim.

Illustration.—Miss Clarke's beautiful figure is taken from the Moreton Bay specimen previously referred to.

PART V.—HETEROSOMATA (No. 1).

ORDER HETEROSOMATA.

"THE FLAT-FISHES."

No one who with open eyes regards the works of Nature, which encompass him on every side in such prodigal profusion, can have failed to notice the want of symmetry which, through having both eyes situated on the same side of the head, characterizes these fishes in the adult state. Except during the earliest stage of their existence the flat-fishes lie at the bottom, when quiescent, on one or the other side, which may be right or left according to the family to which the individual belongs; for an obvious reason these sides are technically termed "eyed" or "blind." The eyed side is invariably colored owing to its exposure to the light, while the blind side, being turned downwards and, therefore, not affected by the rays of the sun, is normally colorless. Exceptions, however, occur to both these laws, for it is not uncommon to find reversed examples among all forms of flat-fishes, so that a normally "dextral" species—that is a species having the eyes on the right side—becomes individually "sinistral"—having the eyes on the left side—and *vice versa*; specimens too are occasionally taken, which are more or less fully colored on both sides. Indeed it is well known that certain species, among them our "Queensland Halibut" (*Psettodes erumei*) are dextral or sinistral in about equal numbers. It is probable that the species, which exhibit this divergence from the common law in a more marked degree, are more directly descended from their pereoid ancestry, than those which have developed a more constant dextrality or sinistrality.

For many years it has been known that the young flat-fish, on its emergence from the ovum, has the eyes, like those of other fishes, placed symmetrically on the opposite sides of the head, and that at this period the body assumes a vertical position when the fish has occasion to move from place to place. At a very early age, however, one eye is forced round the dorsal surface of the head, and thenceforward becomes the upper eye, as distinguished from the lower, in which no such compulsory migration has taken place. The relationship of the eyes to one another, both as to size and position, varies greatly in the different genera, and when taking the proportionate measurements of the eye to the head, or more specially to the snout, it is preferable to utilize the lower eye, as being, from its immobility, the more constant. It is to this compulsory migration of an eye that the asymmetry of the frontal bones among

the flat-fishes is wholly due, that of the blind side being much the broader, while the frontal of the eyed side is displaced outwards and downwards to form an interorbital bar, the main portion of which is on the wrong side of the eye.

For a long time it was considered that the movement of the eye resulted in a torsion of the orbital region of the skull, but modern embryological research does not bear out this view. Rather it appears that of the two cartilaginous supraorbital bars, which in the larva are the precursors of the frontal bones of the adult fish, that part, which lies in the path of the migrating eye, is rapidly absorbed, and thus reduced to a pair of processes, directed respectively forward and backward, between which the eye passes and, in assuming its final position, causes a torsion of the supraorbital bar of the future eyed side, which also affects the ethmoid region, ossification not taking place until the migration is complete.

Recent research into the modifications of the orbital and nasal regions of the cranium, and the composition of the fin-rays in these fishes, tends to prove that the HETEROSOMATA, instead of being asymmetrical gadoids, as was held by earlier writers, have a closer affinity to the percoid fishes. *Psettodes*, in fact, with its spinous fin-rays to the dorsal and ventrals, and the more or less vertical position assumed by the body when the fish is moving rapidly, is merely an asymmetrical percoid. In other genera some of the dorsal, anal, and ventral rays are simple, and plainly represent spines reconverted to articulated rays.

Geologically the heterosomes date back only to the Upper Eocene, and are, therefore, a but recently differentiated group. Species inseparable from the existing genera *Bothus* and *Solca* have been discovered in that formation, but with these exceptions heterosome remains are few, fragmentary, and inconclusive. According to Regan the extinct *Amphistiidae* of the same geological age are percoids, with affinities to the recent genus *Psettus* (Diamond Fishes), or perhaps to *Platax*—near which it is arranged by Woodward¹—and hypothetically are the symmetrical prototypes of the flat-fishes. Up to the present time but one species—*Amphistium paradoxum* Agassiz²—has been discovered; it is associated by Boulenger³ with the *Zeidæ* (Dories).

Geographically the Order is practically cosmopolitan, being found in greater or less abundance wherever fisheries can be maintained, and though, as might be conjectured, it is richer in genera and species in the warmer seas, it is to the colder waters of the North Temperate Zone that we must turn, in order to find them in the full zenith of their power and influence.

Their bathymetrical distribution is also very great, for though the majority of flat-fishes lead a wholly marine life, many species prefer the muddy waters of estuaries to the purity of the open bay, and a few degenerates, chiefly of the soleiform group, elect to pass their entire existence in fresh water. A large number are denizens of the litoral zone, and, as they take a bait greedily and fearlessly, have thereby endeared themselves to the heart of the juvenile angler the world over. But a large and important section—those which enter into the economic food supply of mankind—is taken by the trawl-net, the boulder, and the hand-line, at greater depths offshore, even up to 300 fathoms, at which depth the halibut fishery of the Banks of Newfoundland is lucratively prosecuted.

¹ Brit. Mus. Catal. Foss. Fish., iv, 1901, p. 434.

² Poiss. Foss., v, pt. i, p. 44, pl. xiii.

³ Cambridge Nat. Hist., vii, 1904, p. 684, fig. 417.

Many species descend to below the 500 fathoms line, and a few to much greater depths. *Citharichthys dinoceros*,⁴ for example, was trawled by the "Blake" off Barbados from the enormous depth of 955 fathoms (a mile and an eighth of vertical depth), and a congener of the small but sweet-flavored "dab" (*Limanda limanda* 'Linnaeus'⁵) of the British seas was brought up by the "Albatross" from 896 fathoms, and was christened *Limanda beanii* by the late Dr. Brown Goode.⁶

The HETEROSOMATA may be defined as follows:—"Asymmetrical physoclists having the body strongly compressed with short precaudal region; mouth more or less protractile, the premaxillaries forming the entire dentigerous border of the upper jaw; eyes situated on the same side of the head in the adult. Dorsal and anal fins long; caudal with 18 or fewer principal rays, the outer ray above and below usually simple; ventral fins thoracic or jugular, with 6 rays or less. Air-bladder absent in the adult. Interorbital bar mainly formed by the frontal of the eyed side, that of the blind side extending to the prefrontal external to the upper eye; no orbito-sphenoid; parietals separated by the supraoccipital. Vertebral column composed of solid centra, co-ossified with the arches; posterior precaudal vertebrae with downwardly directed parapophyses. Pectoral arch attached to the skull by a forked posttemporal; no mesocoracoid; pelvic bones distinctly attached to the eleuthera."

Though not to be compared, in point of number and variety of species, with the percomorphous stock from which they are descended, the flat-fishes are, nevertheless, a numerous and well-defined group, of great commercial importance to all maritime nations. It is to these fishes that the great trawling industries of the world, which have their chief home in the North Atlantic, and in which so large an amount of capital is involved, owe their existence, and to them primarily they look to justify their continuance.

Although here in Australia we can not boast of the presence of such large and valuable food-fishes as the Turbot, Halibut, Plaice, Sole, and others of the British Seas, we have, notwithstanding, several genera of excellent quality and approved economic importance. Owing, however, to the lack of proper facilities for their capture and the scarcity of suitable fishing grounds off our shelving or coral-strewn coast-line, their value to the community has not been generally appreciated. On no part of the Australian coast has any bank—such as the Dogger Bank of the North Sea⁷—been made known by the Admiralty Surveys, nor is it probable that such exist.

Among Australian flat-fishes it is only necessary to mention such genera as *Symphurus*, *Synaptura*, *Ammotretis*, *Rhombosolea*, *Platophrys*, *Pseudorhombus*, and *Psettodes* to ensure recognition of the fact that the use of more intelligent and systematic means of capture, combined with scientific protection, will in course of time provide lucrative employment for numbers of our hardy fishing population, and bring within reach of every breakfast table an abundant supply

⁴ Goode & Bean, Bull. Mus. Comp. Zool., xii, 1886, p. 157.

⁵ Syst. Nat., ed. 10, 1758, p. 270.

⁶ Goode, Proc. U. S. Nat. Mus., 1881, p. 473.

⁷ This famous bank which has been for many years so unfailing a source of London's fish-supply, is now more prolific than ever, despite the enormous strain which has been laid upon its resources. This marvelous result has been realised solely through the increased attention which science has, during recent years, bestowed upon the conservation of the ova and young of valuable sea-fishes, and the necessity, for placing their natural food supplies under the jurisdiction of a competent and impartial Board, is year by year being more earnestly impressed upon the rulers of all progressive nations.

of cheap nutritious and dainty food. This desirable consummation, however, can not be reached without the hearty and honest co-operation of both providers and consumers.

All the members of this Order are ground-fishes, living and feeding at the bottom, and but rarely invading the realms of the surface fishes.⁸

The ova of all the marine heterosomes are pelagic, and the symmetrical young are chiefly captured by the tow-net in the open sea.

Adult flat-fishes progress by means of an undulating movement of the whole body, which is notably distinct from the vibratory pectoral undulations of the skates and sting-rays.

All the species are carnivorous, subsisting on smaller fishes, crustaceans, mollusks, sand-worms, and in fact on every living creature which they can master.⁹ Nor are some of them averse to feeding upon offal, even the lordly turbot if not preferring at least not disdaining a putrid bait.

Regan divides the HETEROSOMATA into two suborders, the monotypic *Psettodeoidea*, represented by the "Queensland halibut," and the *Pleuronectoidea*, comprising all the remaining flat-fishes. He further separates the latter in two divisions, the *Pleuronctiformes*, with two families and six subfamilies, and the *Soleiformes* with two families. The following key to such of the higher groups as are found in our waters should be useful to Queensland students.

- a*¹. PSETTODEOIDEA :—Dorsal fin not extending forward on the head, the anterior rays spinous; ventral fins with one spinous and 5 soft rays; palatine teeth present; nostrils subsymmetrical PSETTODEIDÆ.
- a*². PLEURONECTOIDEA :—Dorsal fin extending forward on the head, none of the rays spinous; ventral fins with 6 or less soft rays; no palatine teeth.
 - b*¹. Lower jaw prominent; preopercular border free; nostrils asymmetrical (*Pleuronctiformes*).
 - c*¹. Eyes on the left side (*Flounders*) BOTHIDÆ.
 - d*¹. Ventrals with a short base, inserted behind the clavicular arch (*Paralichthyinæ*).
 - d*². Ventral fin of eyed side with a long base extending forward in advance of the clavicular arch (*Platophryinæ*).
 - b*². Lower jaw not prominent; preopercular border adnate; nostrils symmetrical (*Soleiformes*).
 - e*¹. Eyes on the right side (*Soles*) SOLEIDÆ.
 - e*². Eyes on the left side (*Tongue Soles*) CYNOGLOSSIDÆ.

Regan defines the *Soleiformes* as follows:—

DIVISION 2.—SOLEIFORMES.

"Mouth small, terminal, subterminal, or inferior, the lower jaw never prominent; jaws of the blind side toothed, strongly curved, the convexity of the

⁸ The author, when floating in a Rob Roy canoe over a depth of about six feet with a calm sea, on the north coast of Ireland, once saw a plaice (*Pleuronectes platessa*), until then unobserved, dart from its sand-bed and seize a "cudden" (local name for the fry of the coal-fish—*Pollachius virens*) swimming at the surface, retiring then to the bottom to consume its prey at leisure.

⁹ I have seen a large sea-mouse (*Aphrodite aculeata*) taken from the stomach of a brill (*Bothus levis*), though one would imagine that a creature, the hairs of which come off so easily and have such an unpleasant habit of attaching themselves to whatever touches them, would be immune.

lower fitting the concavity of the upper; jaws of the eyed side not or but feebly toothed; preopercular margin not free. Nasal organs symmetrical in position; olfactory laminae arranged transversely to or radiating from a central rachis. Optic chiasma dimorphic, the right or the left nerve dorsal without reference to dextrality or sinistrality. No post-cleithrum; no pectoral radials, the rays inserted on the hypercoracoid; hypocoracoid reduced; pelvic fins supported by the pelvic bones, which are dependent from the lower extremities of the cleithra, which do not reach the ventral profile; precaudal parapophyses united or connected by a bridge to form closed hamal arches; no ribs."

FAMILY I.—SOLEIDÆ.

THE TRUE SOLES.

Body ovate to elliptical, usually covered with small scales. Lateral line straight, sometimes extending on the caudal fin, the tubes simple. Head small; snout rounded and more or less projecting. Eyes on the right side, small, close together, the upper usually in advance of the lower. Caudal fin free, or confluent with the other vertical fins. Pectoral fins present or absent. Ventral fins small, usually both developed, but that of the blind side sometimes rudimentary or even absent, that of the eyed side sometimes median with extended base, separate from or united to the anal. Gill-openings narrow; gill-membranes broadly united below the throat, adnate to the shoulder-girdle above; branchiostegals six; gill-rakers rudimentary. Vertebrae 28 to 57 (9 or 10 + 19 to 48).

Fishes of small or moderate size, inhabiting all tropical and temperate regions, chiefly inhabiting sandy or muddy bottoms at a moderate depth; some, however, have taken on a purely fluviatile existence, such as the *Synaptura selheimi* of Macleay, these being more or less degraded forms; others are equally at home in fresh, brackish, or pure sea water; of such is our *Aserragodes macleayanus* Ramsay, though as far as my observations go the adults confine themselves to the more open waters, descending to a depth of at least 31 fathoms. Some species, however, descend to much greater depths, even the common sole (*Solea solea* Linnaeus), the most universally known of all the family, having been trawled by the "Travailleur" in 130 fathoms, while the same vessel brought up *Microchirus profundicolus* Vaillant from about 700. All the species are excellent eating, but few, however, are of any economic importance.

Our soles divide themselves naturally into two groups, one with separate, the other with confluent vertical fins. Appended is a key to the first group.

*a*¹. Vertical fins separate (*Soleinae*).

*b*¹. Ventrals free from anal.

*c*¹. No pectoral fins.

*d*¹. No accessory lateral line on blind side.

*e*¹. Ventrals subsymmetrical i. ASERRAGODES.

*d*². An accessory lateral line on blind side.

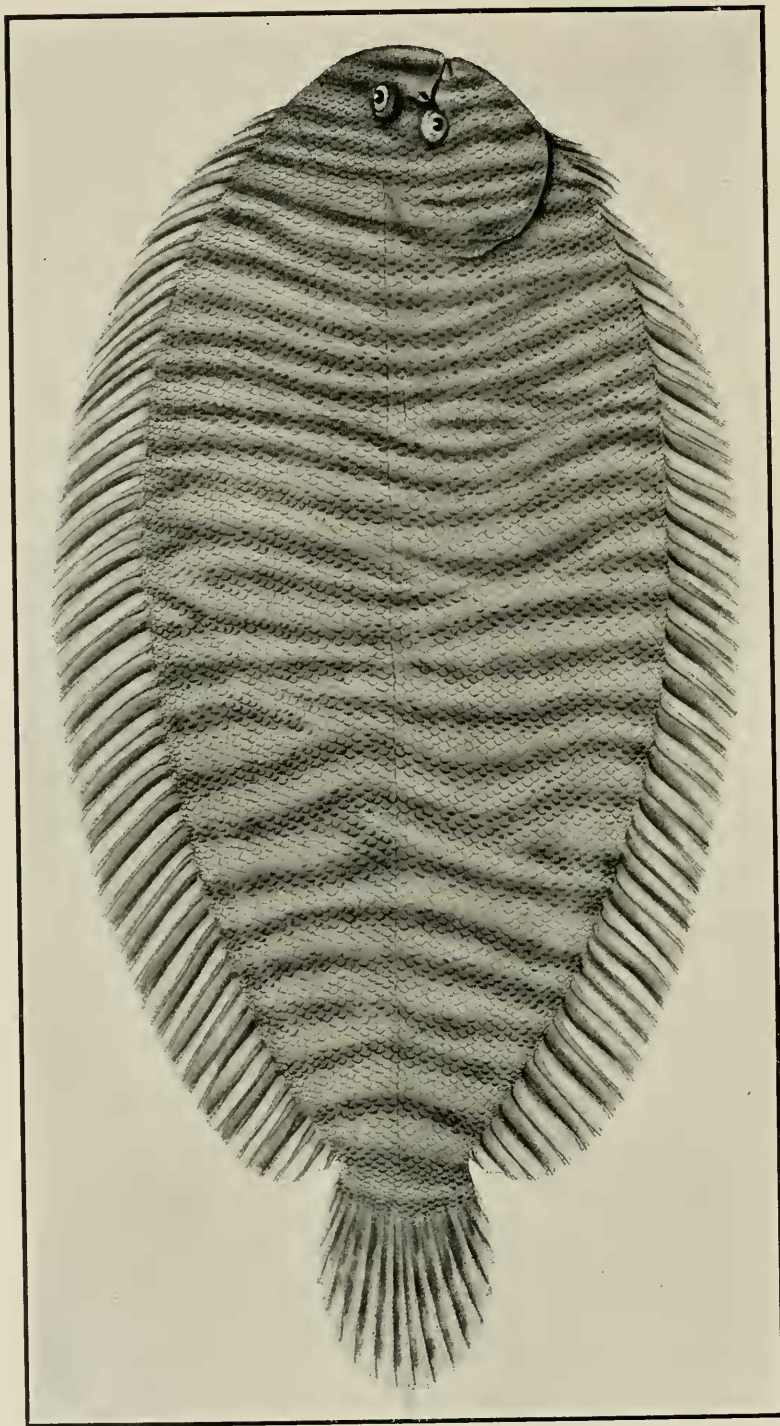
*f*¹. Dorsal and anal fins with a series of suprabasal pores; ventrals asymmetrical ii. PARDACHIRUS.

*c*². Pectoral fins present, that of eyed side the larger.

*g*¹. Rostro-frontal aspect concave; nasal tube of eyed side much produced iii. SOLEICHTHYS.

*a*². Vertical fins confluent (*Brachirince*).¹⁰

¹⁰ As Mr. McCulloch is now making an exhaustive study of the members of this subfamily, I shall await the result of his researches before dealing with the Queensland species.



ASTRAGODES MACLEAYANUS (Ramsay). Nat. Size.

Phyllis Clarke, del.

ASERAGGODES Kaup.

Ascraggodes Kaup, Arch. f. Nat., xxiv, 1858, i, p. 103 (*guttulatus*); Jordan & Starks, Proc. U. S. Nat. Mus., xxxi, 1907, p. 229.

Body ovate, obtusely rounded anteriorly, the caudal peduncle very short and deep. Scales small, adherent, ctenoid, extending on the bases of the vertical fins; head everywhere scaly, except the snout of the eyed side and a narrow stripe on the blind side, from the snout to the apex of the branchial aperture, which is densely clothed with skinny filaments. Lateral line straight, extending on the head and caudal fin, the pores simple. Head small, the snout without hook, not or but little projecting beyond the lower jaw. Mouth terminal or subterminal, narrower on the blind side than on the eyed. Anterior nostril on both sides tubular. Eyes small, the upper a little in advance of the lower, separated by a narrow scaly concave interspace. Dorsal originating on the snout, anal slightly in advance of the opercular angle; most of the rays divided, with the tips free, and a skinny pleat on the blind side. Caudal fin sharply rounded, with 18 rays, of which 15 are divided. No pectoral fins. Ventrals subsymmetrical, the right but little longer and not higher than the left, the rays simple, both inserted symmetrically on the edge of the abdominal ridge, and separate from or united to the anal. Gill-openings narrow; gill-membranes broadly united below; gill-rakers rudimentary. Vent submedian. (*a*, priv., *σπαγγώδης*, full of pores.)

Small thick soles, inhabiting the inshore waters of the Australian and Malayan Seas, ranging northward to Japan and eastward to the Solomons and Lord Howe Island. About a dozen species known.

ASERAGGODES MACLEAYANUS (Ramsay).

(Plate XV.)

- Solea Macleayana* Ramsay, Proc. Linn. Soc. N. S. Wales, v, pt. 4, 20 May 1881, p. 462; Macleay, Proc. Linn. Soc. N. S. Wales, vi, 1881, p. 135; id., *ibid.*, vii, 1882, p. 15.
Solea fluviatilis Ramsay, *ibid.*, vii, pt. 1, 23 May 1882, p. 111; Macleay, *ibid.*, ix, 1884, p. 50; Ogilby, Catal. Fish. N. S. Wales, 1886, p. 49.
Solea macleayana Woods, Fish & Fisher. N. S. Wales, 1882, pp. 21, 77; Ogilby, *ibid.*; id., Edib. Fish. N. S. Wales, 1893, p. 159; Stead, Fish. Austr., 1906, pp. 183, 264.
Ascraggodes macleayanus Ogilby, Proc. Linn. Soc. N. S. Wales, xxi, 1897, p. 817; id., Proc. Roy. Soc. Queensl., xxi, 1908, p. 25; id., List Edib. Fish. Moreton Bay, 1911, p. 1.
Ascraggodes macleayana Waite, Mem. Austr. Mus., iv, 1899, pp. 29, 124, pl. xxix; id., Synops. Fish. N. S. Wales, 1904, p. 44; Stead, Edib. Fish. N. S. Wales, 1908, p. 105, pl. lxxii.

NARROW-BANDED SOLE.

Type localities:—Manly Beach, N.S.W. (*S. macleayana*).

Hunter River, N.S.W. (*S. fluviatilis*).

Sides of body nearly parallel from behind the head to well beyond the middle, thence gradually converging to the peduncle, the depth of which is 3.5 to 4 in that of the body, which is 2.1 to 2.3 in its length. Head deeper than long, its length 5 to 5.3 in that of the body. Snout short, its tip on a level with the inferior border of the lower eye, its length from that eye 3.6 to 3.8 in that of the head. Cleft of mouth extending to below or a little beyond the anterior border of the lower eye. Anterior nostril of colored side tubular, wide, situated in front of the upper half of the lower eye; posterior valvular, pierced in the

angle between the eye and the lip; nostrils of blind side tubular, widely separated, the anterior opening near the edge of the snout, the posterior behind the vertical from the angle of the mouth. Eyes of equal size and ovate, their horizontal diameter 1.65 to 2 in the length of the snout, 6.25 to 6.6 in that of the head, and from two thirds to one diameter more than the interorbital width. Width of gill-opening 1.45 to 1.55 in the length of the head.

Scales of body and head strongly etenoid on both sides, the marginal teeth from 6 to 10 in number. Snout and lips of both sides and a wide stripe between the lower jaw and the gill-opening of the blind side naked, the edges and all the naked area of the latter closely covered with short cirri, a series of which is continued to the apex of the gill-opening, the edge of which on the colored side is acirrate. A single median lateral line on each side, extending from near the tip of the caudal fin to the preopercular region, where it bends upwards and slightly forwards. Body-tubes of lateral line 90 to 100; transverse series of scales 32 or 33 / 33 to 35.

Dorsal fin with 62 to 66, anal with 48 to 52 rays, the former originating a little above the level of the upper eye; the highest are inserted in the third quarter of each fin and are from two thirds to four sevenths of the length of the head; those of the anal are slightly the lower. Caudal fin variously rounded, its length 5 to 6 in that of the body.¹¹ Ventrals originating on the same level, 5-rayed, the right about one fifth longer but slightly lower than the left, its 5th ray short, united to the anal by its basal two thirds; last ray of left ventral much longer and free.

Lavender gray, with from 32 to 36 narrow brown cross-bars, which are usually rather wider than the interspaces, and of which 6 or 7 are on the head and 1 or 2 on the base of the caudal fin; these bars are very irregular in shape, the anterior ones often having a slight backward arch, those about the middle of the body straight or undulous and often forked, and the posterior ones arched forwards; membranous part of all the fins darker than the rays. (Named after Sir William John Macleay, in recognition of his valuable services to Australian biology.)

Described from three examples, measuring 192, 168, and 154 millim., taken respectively off Point Lookout and Low Bluff and in Moreton Bay. The largest and smallest were kindly lent to me by the officers of the Amateur Fishermen's Association.

Historical.—During the year 1880 the Trustees of the Australian Museum purchased a small otter trawl for use in Port Jackson and, the Government of the day having placed the steam launch "Mabel" at their disposal, Saturday afternoons were for several years devoted to the exploration of Sydney Harbor, its inlets, and its affluent, an enterprise which largely contributed to our knowledge of the marine fauna of that area. This handsome sole was one of the earliest products of the venture, having been "taken in the net at Manly [inner] Beach, September 11th, 1880, with *Solca microcephala*," as recorded by Dr. Ramsay. In the following year the same author received a small sole (76 millim.)

¹¹ In two of my examples the caudal fin is short and broadly rounded as shown in Waite's figure, the exact proportional measurements being as 1—5.98 and 1—6.06; in the other it is longer and more sharply rounded, with a measurement of 1—4.94. None of my specimens are in spawn, so that I am unable to determine whether the character is sexual or individual, and Waite unfortunately does not mention the sex of the specimen figured.

from "Freshwater, Hunter River" and, possibly misled by the different character of the element in which it was found, redescribed it as *Solea fluviatilis*, his two descriptions being almost word for word the same. No further information was published regarding it till 1893 when I (3) was able to publish some particulars as to its frequency, distribution, and food-value. These notes were supplemented by Waite in his "Thetis" Report, who not only considerably increased its southward and northward range, but was able to fix the spawning season for Middle New South Wales, a most important advancement in the sum of our knowledge of the economy of the species. Some years later Stead increased its range north to Port Macquarie, while in the same year I was able to announce its presence in Queensland waters, several young examples having been brought to me for identification by Mr. William Nicklin, who obtained them in the Brisbane River.

Reproduction.—In my "Edible Fishes of New South Wales" I stated that these soles "are occasionally found in considerable numbers, especially during the spring months, when they come in apparently from the open sea in shoals, all being of large size and about the same length; these school fish are very thick and firm and of delicious flavor, but are without rudiments of spawn." Waite's investigations on board the "Thetis" tend to confirm my observations, for he writes that "all the specimens of sufficient size were full of almost ripe ova, and as the extreme dates are the 2nd and 19th March, the end of that month may be approximately determined as the spawning season," and elsewhere "we . . . discovered the breeding season to be March and April." These remarks apply to the coast of New South Wales between Shoalhaven Bight and Cape Hawke, and we may naturally infer that with us the season would be a full month later or the latter part of April and May. This supposition receives a partial confirmation in that none of the 15 adult examples captured by the "Endeavour" in the neighborhood of Moreton Bay during the first week of September showed signs of breeding. It will be noticed that at least three of the stations where spawning fishes were trawled by the "Thetis" lie off the mouth of considerable rivers (Shoalhaven and Hunter), and I believe that the procedure may safely be outlined thus:—In the spring of the year the fishes, which have spent the winter months in moderately deep water, begin to draw inshore, and this movement doubtless continues with more or less regularity throughout the summer, during which time the ova is gradually ripening, that of the individuals which make their way shorewards earliest coming to maturity sooner than that of the later arrivals. As the time for shedding the spawn approaches the fishes collect in the vicinity of river mouths, where they shed their pelagic ova, after which operation they retire once more to deeper water to recoup. The young fishes, as soon as the yolk-sac is absorbed, make their way into the estuaries, and gradually work up these even to far beyond the limit of the tide, as we know from the Hunter River example described by Ramsay as *Solea fluviatilis*, and from a specimen exhibited by me at a meeting of the Linnæan Society of New South Wales, which was captured at Codrington, a township on the Richmond River 58 miles above its mouth.

Uses.—A delicious pan-fish, fully equal in flavor to its famous European relative, *Solea solea*. Waite writes—"As to its edible qualities all on board the 'Thetis,' where it was freely partaken of, pronounced it to be of admirable

flavour." Stead makes no remark as to its quality, but contents himself with stating that it "may be considered as likely to be of some use as an adjunct to our food-supply in the near future."¹²

Range:—Coasts of New South Wales and Southern Queensland from the Shoalhaven Bight in the south to the Moreton Bay District in the north. From our own coast I have seen specimens from Currumbin Creek, Southport, Moreton Bay, Brisbane River, and from the "Endeavour" stations—off South Hill in 13 fath. on fine dark sand 2, off Point Lookout in 31 fath. on fine sand and shell 6, off Cartwright Point in 24 fath. 4, and off Low Bluff in 15 fath. 3, both these latter on fine sand. According to Waite the "Thetis" also obtained it at four stations, namely—Newcastle Bight in 19 to 16 fath. on "mud and sand to pebbles"; off Newcastle in 21 to 48 fath. on sand and mud; off Cape Hawke in 10 to 12 fath. on sand to gravel; and off the Shoalhaven River in 15 fath. on sand. Regarding the second of these stations Waite remarks—"Although 21-48 fathoms was sounded at Station 24 it is quite possible that this fish was taken when the trawl was first lowered and before it descended to greater depths. It may be further pointed out that it was obtained most abundantly in the shallowest water wherein we trawled," which is diametrically opposed to the "Endeavour's" experience here; this only shows that, as suggested above, the breeding fishes were drawing in to the shallow water off the mouths of rivers preparatory to shedding their spawn, while the stripped fishes were widely scattered over the ocean bed at a much greater depth.

Dimensions:—As both Waite and I found 280 millim. (11 in.) to be the largest size obtainable, this may be taken as the maximum length to which the species attains. A more usual size is from 200 to 225 millim., and Waite records that "it is mature at a much smaller size, for a large number of our specimens measuring only six inches in length were in full spawn."

PARDACHIRUS Günther.

Pardachirus Günther, Brit. Mus. Catal. Fish., iv, 1862, p. 478 (*marmoratus*).

Body ovate, obtusely rounded anteriorly, the caudal peduncle very short and deep. Scales small, adherent, variously armed, extending on the bases of the vertical fins; head everywhere scaly; edges of snout, lower jaw, and branchial aperture fringed, under surface of snout and lower jaw densely clothed with skinny filaments. Lateral line straight, that on the blind side extending forwards by a gentle curve to the snout, where it joins a second line, which runs from the tip of the snout close below the upper profile of the head and nape; vertical fin-rays each provided with a pair of open pores. Head small, the snout projecting beyond the lower jaw, but without hook. Mouth small and lunate, narrower on the blind side than on the eyed. Teeth minute and setaceous, in villiform bands, on the blind side only. Anterior nostril of eyed side and both nostrils of blind side tubular; posterior nostril of eyed side simple, close in front of the lower eye, and concealed beneath the ascending flap of the lower lip. Eyes small, dextral, separated by a narrow scaly concave interspace, the upper a little in advance of the lower. Dorsal originating in front or a little below the upper eye, anal below the opercular angle, the rays divided, with the

¹² We are looking forward with great interest to Mr. Stead's first report on the proceedings of the New South Wales trawlers—Koraaga, Gunnundaal, and Brolga. Much important information regarding the breeding places and seasons of our food-fishes may, and it is hoped will, be obtained through their instrumentality. We wish the New South Wales Government and Mr. Stead all good fortune in this venture, and trust that the Government of this State will as soon as possible emulate their praiseworthy and patriotic action by stimulating the scientific development of our fisheries on the lines laid down by me in letters to local journals.

tips free. Caudal broadly rounded, with 18 rays. No pectorals. Ventrals asymmetrical, the right the larger, inserted on the abdominal ridge, but not connected with the anal. Gill-opening narrow; gill-membranes broadly united below the throat; branchiostegals 6; gill-rakers rudimentary. Vent situated on the left side behind the left ventral. (*παρδος*, a leopard; *Achirus*, an allied genus.)

In some specimens there is a simple papilla situated on the abdominal ridge in front of the anal and on a level with the vent; in others there is a broad cutaneous flap embracing not only the vent but the origin of the anal fin. That this is a sexual character there can be no doubt, but as none of my specimens are in spawn I cannot determine to which sex each belongs.

Small thick soles, inhabiting the litoral waters of the Indian and Western Pacific Oceans. About 4 species.

The characters which are supposed to separate the five genera of soles, in which the pectoral fins are wholly wanting, are slight and unconvincing. *Pardachirus*, however, is said to differ from all the others in the presence of a series of conspicuous open pores situated along both sides of the bases of the vertical fins. With these is correlated an accessory lateral line on the blind side anteriorly. But this latter character it only possesses in common with *Liachirus*, which is in fact nothing more nor less than a poreless *Pardachirus*. Again, Günther's statement regarding his own genus *Pardachirus*, "scales not ciliated, or only a few with inconspicuous cilia," cannot be maintained. Not only are the scales of the Port Jackson species, hitherto known as *P. pavoninus*, conspicuously ctenoid everywhere on both sides, but the same has been noticed by Day of the Indian *P. maculatus* Schneider, and by Kendall and Goldsborough of a supposed specimen of *P. pavoninus* from Tonga. The positions of the four Bleekerian species of *Achirus*, namely, *A. melanospilos*, *A. poropterus*, *A. thepassii*, and *A. hartzfeldii*, are most confusing. Jordan and Richardson refer the two latter to the genus *Amate* Jordan and Starks. Granted that the long-snouted *A. hartzfeldii* may with propriety be placed in the same section as *Amate japonica*, the like cannot be said for the short-snouted *A. thepassii*. This species, with *A. poropterus*, oscillates between *Aseraggodes* and *Pardachirus*, having the single lateral line of the former and the basiradial pores of the latter. If, therefore, both these genera are valid, a new name will be required for Bleeker's species. Similarly the smooth-scaled *A. melanospilos*, being practically a *Liachirus* with a single lateral line, should command yet another new generic name. Enough has been said to show that the status of the four genera *Aseraggodes*, *Pardachirus*, *Liachirus*, and *Amate* is very doubtful.

Key to the Species of Pardachirus.

- a*¹. Scales everywhere cycloid *marmoratus*.
- a*². Scale of head and sometimes of anterior trunk ctenoid, ocelli of colored side each with a dark central spot; back without black blotches *pavoninus*.
- a*³. Scale everywhere ctenoid; ocelli of colored side usually without central spot; back with three series of black blotches *hedleyi*.

Day places in this genus, which he calls *Achirus*, the fish described by Schneider as *Pleuronectes maculatus*, and informs us that he had the privilege of examining the type, which is unique. His description of it as congeneric with *P. pavoninus* is, however, far from convincing. The hooked snout and the complete lepidosis of the vertical fins are not pardachirine characters, while the evidence as to the presence of radial pores is decidedly weak.

PARDACHIRUS PAVONINUS (Lacépède).

(Plate XVI.)

Achirus pavoninus Lacépède, Hist. Nat. Poiss., iv, 1902, pp. 658, 661; Cantor, Catal. Malay. Fish. 1850, p. 225; Bleeker, Nat. Tijds. Nederl. Ind., i, 1851, p. 402; id., ibid., iii, 1852, pp. 238, 446; id., Verh. Batav. Gen., xxiv, 1852, Pleuronect., p. 18; id., Nat. Tijds. Nederl. Ind., xii, 1857, p. 217; Kaup, Arch. f. Naturg., xxiv, 1858, i, p. 102; Bleeker, Act. Soc. Sci. Indo-Neerl., viii, 1850, Sumatra, p. 62; id., ibid., Celebes, p. 14; id., Versl. Akad. Amsterdam, xii, 1861, pp. 41, 69; id., ibid., xiv, 1862, p. 103; id., Nederl. Tijds. Dierk., ii, 1865, p. 184; id., Atlas Ichth., vi, 1870, p. 24, pl. cexli, fig. 1; id., Versl. Akad. Amsterdam (2) vii, 1873, p. 37; Day, Fish. India, pt. 3, 1877, p. 427, pl. xciii, fig. 2; Bleeker, Verh. Akad. Amsterdam, xviii, 1879, China, p. 3; Stead, Fish. Austr., 1906, pp. 183, 264.

Pleuronectes pavoninus Shaw, Gen. Zool., iv, 1804, p. 310.

Achirus maculatus (Kuhl & van Hasselt) Bleeker, Nat. & Geneesk. Arch. Ned. Ind., ii, 1845, p. 509; Verh. Batav. Gen., xxii, 1849, Madura, p. 6; id., ibid., xxiii, 1850, Mid-en Oost-Java, p. 12.

Pardachirus pavoninus Günther, Brit. Mus. Catal. Fish., iv, 1862, p. 479; Day, Proc. Zool. Soc. London, 1870, p. 699; Alleyne & Macleay, Proc. Linn. Soc. N. S. Wales, i, 1877, p. 247; Macleay, Proc. Linn. Soc. N. S. Wales, vi, 1881, p. 136; Kent, Great Barrier Reef, 1893, p. 297; Steindachner, Abh. Senck. Ges., xxv, ii, 1901, p. 443; Jordan & Seale, Bull. U. S. Bur. Fisher., xxv, 1906, p. 413; Evermann & Seale, Bull. U. S. Bur. Fish., xxvi, 1907; Günther, Fisch. d. Sudsee, 1909, p. 346; Jordan & Richardson, Check-List Fish. Philipp. Archip., 1910, p. 54; Snyder, Proc. U. S. Nat. Mus., xlii, 1912, p. 517; Weber, Fisch. Siboga Exped., 1913, p. 439.

? *Pardachirus marmoratus* Kner, Reise Novara, pt. 3, 1867, p. 290. Not of Lacépède.

Solea (*Pardachirus*) *pavonina* Steindachner, Sitz. Akad. Wien, lx, 1870, p. 570.

PEACOCK SOLE.

Type locality:—East Indies (*A. pavoninus*).

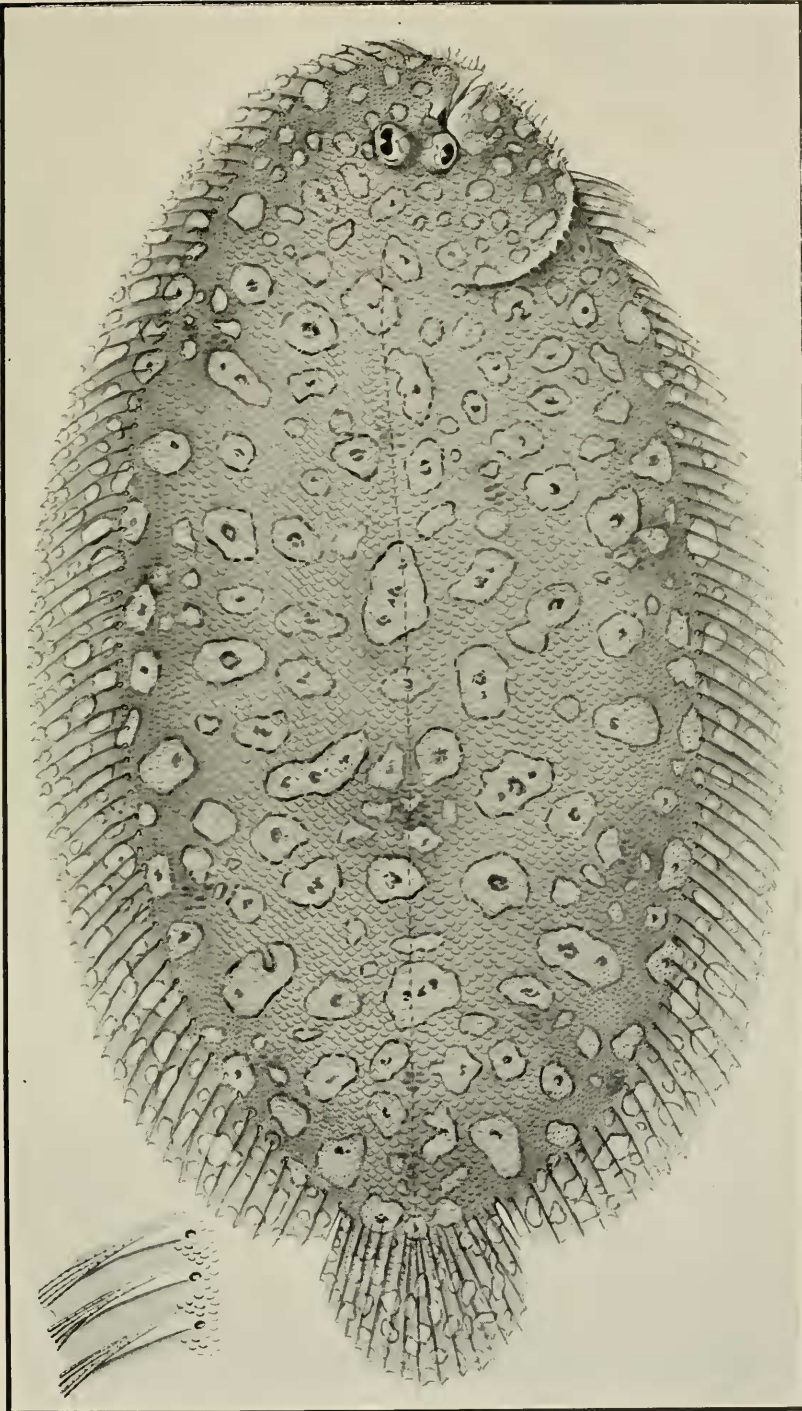
Java (*A. maculatus*).

Body ovate, its depth 2.2 in its length, that of the caudal peduncle 2.43 in the body-depth. Head somewhat deeper than long, its length 4.83 in that of the body. Snout short, its tip somewhat below the level of the lower eye, its length from that eye 2.85 in that of the head. Cleft of mouth extending to below the anterior third of the lower eye. Eyes equal, the diameter 5.9 in the length of the head. Width of gill-opening 1.5 in the same.

Seales of the upper side terminating in an ovate feebly spinulose patch, which becomes gradually weaker posteriorly, the margins smooth, except above the eyes where they bear 3 or 4 longer setæ; lower surface smooth, in 84 to 89 transverse series above the lateral line. Basal third of vertical fins sealy, the basiradial pore opening on the inner edge of the naked portion. Lateral line straight, continued to the extremity of the caudal fin, and on the head to the preopercular region where it divides, one branch passing upwards the other downwards.

Dorsal fin with 65 to 71, anal with 50 to 54 rays, all of which, except a few short ones in front and behind, are divided, the longest rays being about the commencement of the last third of the fin. Caudal fin broadly rounded, with 18 rays, its length 5.87 in that of the head. Each ventral with 5 branched rays.¹³

¹³ In the specimen described the right ventral has a short additional ray posteriorly, but as other observers give the formula as 5/5, I look upon this as an individual peculiarity.



PARDACHIRUS PAVONINUS (Lacépède). ♂ Nat. Size.

Phyllis Clarke, del.

Described from a single example, 205 millim. long, obtained at Raine Island, N.Q., and presented to the Queensland Museum by the Wanetta Pearling Company. Reg. No. I. 14/1917. The number of scales and of dorsal and anal rays is, however, supplemented by information kindly supplied by Mr. McCulloch.

Historical:—This beautifully marked sole was first made known to science in the early years of the nineteenth century by Lacépède, who placed it in the first subdivision of his genus *Achirus*, along with his *A. barbatus*, *A. marmoratus*, and *A. fasciatus*. The two first of these are congeneric with the subject of this article, nevertheless Cuvier arbitrarily selected a species—*Pleuronectes achirus* Linnaeus—of which Lacépède makes no mention, as the type of the restricted genus *Achirus*, and his example has unfortunately been followed by those writers who succeeded him, with the exception of Kaup, to whose honor it is that he restored *Achirus* to those fishes for which Lacépède originally designed it.¹⁴ In the edition of Lacépède's works to which I have access (Paris 1836) no locality is mentioned for this fish, but since it is stated that the type belonged to the collection of the Stadtholder, annexed from Holland by France during the Napoleonic wars, we may safely conclude that it came from the Dutch East Indies. With the exception of a passing reference by Shaw, who referred it back to the genus *Pleuronectes*, nothing more was heard of this fish until, under the name of *A. maculatus*, its presence in Batavian waters was announced by Bleeker some forty years later on the authority of the MSS. of Kuhl and van Hasselt. By the same name Bleeker subsequently recorded it from Madura and Sourabaya. Cantor in 1850, restoring Lacépède's name, reports a single specimen as having been obtained at Pinang some years previously. From this period until 1860 its history consists of a series of records by Bleeker for various islands of the Malay Archipelago; indeed, so far as that author is concerned, the series is continued up to 1879, when he added it to the Chinese fauna on the strength of a specimen contained in the Hamburg Museum; all these later records are given under *A. pavoninus*. In 1860 Günther initiated a new era in the history of this fish by forming for it and its Lacépédian congeners *A. barbatus* and *A. marmoratus*¹⁵ the genus *Pardachirus*, which is now generally recognised, the most notable exceptions being Day, who followed Kaup, and Ogilby, who followed Day and was followed by Waite and Stead. The earliest notice of its occurrence on the shores of Australia was published in 1877 by Alleyne and Macleay, who obtained their specimens at Capes Grenville and York, N.Q., during the Chevert Expedition. Two years later Castelnau included the species in a list of Port Jackson fishes, but the southern Peacock Sole is easily recognisable from its northern relative by the etenoid character of its scales. Steindachner obtained a pair from Ternate, an island which is not represented in Bleeker's list. Coming to recent times Jordan and Seale extended its range to the New Hebrides, while Günther added New Britain, the Solomons, and the Tonga Group. Jordan and Richardson announced its presence in the Philippines, and Snyder recorded specimens from as far north as Okinawa, an island of the Riu Kiu Archipelago. Finally Weber reported it from Samoa, the most easterly point as yet noticed.

¹⁴ International zoological jurisdiction has, however, found it expedient to uphold the wrong-doer, and thus forced us into the incongruous position of accepting that which we know to be a manifest absurdity, or worse.

¹⁵ These are considered to be identical.

Uses.—Lacépède, writing of the allied *P. marmoratus*, states on the authority of Commerçon that "the flavor of its flesh is excellent," and from a single personal experience I can similarly affirm that the southern *P. hedleyi* is equally delicious. The mouth is too small to admit of its taking an ordinary hook, and it could only be taken in sufficient numbers for the table by the use of small otter trawls in water of not more than 7 or 8 fathoms. That it is almost wholly a fish of the littoral zone is borne out by the failure of the "Endeavour" to trawl even a single example on the Queensland coast.

Range.—From the shores of Northern Queensland westward through the Malay Archipelago to the Andamans and Pinang, and thence northward along the coast of China to the Riu Kiu Islands; northward and eastward from our shores it has been recorded from the New Hebrides (*Jordan & Seale*), New Britain, Solomons, and Tonga (*Günther*), and Samoa (*Weber*). On the Queensland coast it is known from Capes Grenville and York, N.Q. (*Alleyne & Macleay*); Raine Island, B.R. (*Ogilby*); and Darnley Island (*Tosh Coll.*). Turning westward we find it recorded from the Aru Islands, Ceram, Batchian, Celebes, Madura, Java, Banca, Singapore, Nias, and Sumatra (*Bleeker*); Ternate (*Steindachner*); Bacon, P.I. (*Evermann & Seale*); Pulo Pinang (*Cantor*); Andaman Islands (*Day*); China Sea (*Bleeker*); and Okinawe (*Snyder*).

Dimensions.—The largest of which I can find any record measures 209 millim., and is the Raine Island example—I. 15/2491—which Miss Phyllis Clark has so beautifully illustrated.

PARDACHIRUS HEDLEYI sp. nov.

(Plate XVII.)

Pardachirus pavoninus Castelnau, Proc. Linn. Soc. N. S. Wales, iii, 1879, pp. 355, 362; Macleay,

Proc. Linn. Soc. N. S. Wales, vii, 1882, p. 13. Not of Günther 1862.

Achirus pavoninus Ogilby, Catal. Fish. N. S. Wales, 1886, p. 49; Waite, Synops. Fish. N. S. Wales, 1904, p. 44; Stead, Edib. Fish. N. S. Wales, 1908, p. 106. Not of Lacépède 1802.

? *Pardachirus pavoninus* Kendall & Goldsborough, Mem. Mus. Comp. Zool., xxvi, 1911, p. 332.

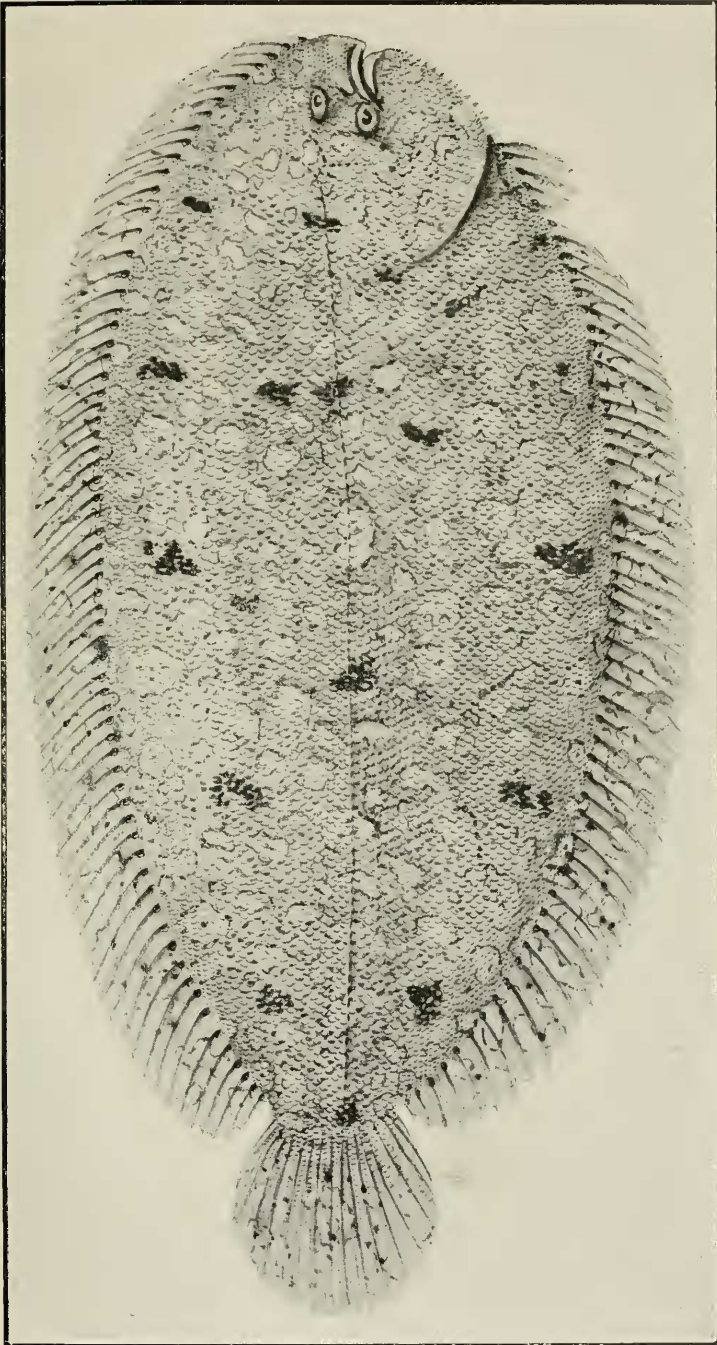
Type locality.—Port Jackson, N.S.W.

Body ovate, its depth 2.3 to 2.55 in its length,¹⁶ that of the caudal peduncle 3.5 to 3.65 in the body-depth. Head about one fifth deeper than long, its length 4.6 to 5 in that of the body. Snout short, its tip slightly below the level of the lower eye, its length from that eye 3 to 3.5 in that of the head. Cleft of mouth extending to below the middle of the lower eye or not quite so far. Eyes equal, the diameter 6.2 to 6.67 in the length of the head. Width of gill-opening 1.45 to 1.6 in the same.

Scales of both sides terminating in an ovate spinulose patch, the margin of which is armed with about 8 longer and stronger teeth, in 82 to 90 transverse series, immediately above the lateral line. Only the basal third of the vertical fins is scaly, and the basiradial pore opens on the inner edge of the naked portion.¹⁷ Lateral line with an inconspicuous curve in the pectoral region, continued to the

¹⁶ One example (I. 15/2491) is exceptionally short and deep, its depth being 2.15 in its length.

¹⁷ Günther, in his diagnosis of the genus, writes—"Dorsal and anal rays scaly." However this may be with *P. marmoratus*, it is certainly incorrect as regards *P. pavoninus* and *P. hedleyi*.



PARDACHIRUS HEDLEYI Ogilby. Nat. Size.

Phyllis Clarke, del.

extremity of the caudal fin. On the right side it is extended forward to the preopercular region, and just before its termination throws off two short branches, directed upwards and downwards.

Dorsal fin with 65 to 74, anal with 50 to 55 rays, all of which, except a few short ones in front and behind, are divided; the longest rays are inserted about the commencement of the last quarter of the fins (D. 48th to 53rd, A. 35th to 39th), and the latter fin is a little the higher. Caudal fin broadly rounded, with 18 rays, its length 5 to 5.75 in that of the body. Each ventral with 5 branched rays.

Vinaceous brown, the head, body, and fins profusely ornamented with lavender-gray dark-edged spots of variable shape and size, which sometimes contain one or more darker dots, but are more commonly plain; usually three series—dorsal, median, and ventral—of large suffused blackish spots on the body; these, however, may be broken up into more numerous and clearly defined spots scattered irregularly over the side; head usually without black spots. Lower surface yellowish white. (Named after my friend Charles Hedley, the premier conchologist of Australia.)

Described from 9 examples, measuring between 118 and 152 millim.; 8 of these were taken in Port Jackson, the ninth in Moreton Bay.

Historical:—The earliest notice which we have of this fish is from the pen of Count Castelnau, who introduced it into his list of Port Jackson fishes, published in 1879, confounding it, however, with the preceding species. Castelnau's error was perpetuated by Macleay, Ogilby, and subsequent writers on the ichthyology of New South Wales, and is only now corrected, because it became necessary for me to make a thorough examination of the peacock soles of Eastern Australia for the purposes of this work, when the differences between the two species were at once apparent.

Habits:—This pretty little sole is common in suitable localities in Port Jackson, and probably along the greater part of the coastline of New South Wales and South Queensland, at least as far north as Moreton Bay. It is, however, little known anywhere along the stretch of coast referred to, escaping observation because the smallness of its mouth precludes it from taking any hook in ordinary use. If, however, the otter trawl were more generally employed, we should possibly find that a fair supply of this delicious little fish could be obtained for the market.¹⁸ Like its congeners this sole is entirely an inhabitant of the litoral zone, preferring such localities as have a sandy, mixed sandy and muddy, or gravelly bottom in from 3 to 7 fathoms water. Stead writes of it as follows:—"This beautifully ornamented species is not of present economic importance. It appears to be purely an estuarine fish, affecting sandy bottoms, and occurring in the waters along the greater part of our coastline. It is rarely seen in our markets, and is not often captured."

Uses:—A most delicious morsel.

¹⁸ This at least we found to be the case in Port Jackson when, some thirty years ago, it was the weekly custom of the Australian Museum staff, under the leadership of Dr. Ramsay, to spend Saturday down the harbor with otter trawl and dredge. By this means the local fauna was enriched by many scarce and not a few new species. Occasionally as many as a dozen specimens of *Pardachirus* were caught, Rose Bay being a favorite ground. This custom might well be initiated here with much advantage to our own Museum.

Food.—Remains of small crustaceans, mollusks, and a worm were found in the stomachs of two specimens examined.

Range.—Coasts of New South Wales and Southern Queensland. Besides Port Jackson and Moreton Bay the only locality from which I have seen this sole is Byron Bay, N.S.W., where the "Endeavour" trawled a specimen when en route to Moreton Bay in July, 1910.

PART III.—CARANGIDÆ (No. 2).

SUBFAMILY TRACHINOTINÆ.

THE SWALLOWTAILS.

Litoral carangoid fishes, inhabiting all warm seas, distinguished by the unarméd tail, the long anal fin¹ which is similar to the soft dorsal and exceeds in length the abdominal region, and the short non-falcate pectoral fins. Genera 5; species about 28.

As is the case with all nearly related forms the swallowtails or pámpanos,² to use a convenient general term, are partially migratory, though their movements are for the most part regulated by the abundance or scarcity of the food supply. That climatic conditions, however, influence to some extent their periodical migrations, seems to be indicated by the fact that our common swallowtail (*T. bolla*),³ though present in our waters at all seasons of the year, visits our shores in large schools during the winter months. These fishes presumably come from the south, since they are usually associated with the shoals of "sea mullet" (*Mugil cephalus dobula*) at that season coasting northwards to their breeding-grounds. The pámpanos swim high in the water and, through the instrumentality of their powerful caudal fin, are able not only to move with extreme rapidity, but also to turn sharply on their course with the minimum loss of time and speed. They are, therefore, very destructive to the young of other fishes, which form a great part of their food, along with swimming crabs, squid, and certain mollusks which they seek among the breakers.

Opinions vary greatly as to the gastronomic value of these fishes, but modern popular opinion apparently agrees in regarding the majority of the species as being dry and insipid. There are, however, some notable exceptions, as for instance *Trachinotus carolinus*,⁴ the "common pámpano" of the Southern Atlantic and Gulf States of North America, which Jordan and Evermann characterise as "the most valued food-fish in our southern waters, its flesh rich,

¹ Except in *Campogramma* Regan, in which the anal is much shorter than the dorsal and about as long as the abdominal region (i.e. the space between the origin of the ventrals and the soft anal), and the pectorals are subfalciform.

² The dictionaries spell this word "pompano," but I have followed Jordan & Evermann (Fish. North & Mid. America, pt. i, p. 944) in adopting the above as the more classical orthography. Cuvier & Valenciennes too employed this reading, having named the species, which we now know as *Trachinotus carolinus*, *T. pampanus*.

³ Mem. Queensl. Mus., iii, pp. 93-98.

⁴ *Gasterosteus carolinus* Linnaeus, Syst. Nat., ed. 12, p. 490.

firm, and delicate, superior to all others of its genus and family";⁵ again Jordan "The true pámpano is one of the finest of all food-fishes, ranking with the Spanish mackerel, and to be cooked in the same way, only by broiling. The flesh is white, firm, and flaky, with a moderate amount of delicate oil."⁶ Referring to *T. palometa*⁷ Valenciennes⁸ states that "its flesh is excellent," but quotes l'Herminier to the effect that it is only good when in condition, but at other times is regarded with suspicion"; a remark which might with equal truth be made about many other fishes. Jordan and Evermann speak of it as "not highly valued,"⁹ of *T. rhodopus*¹⁰ as "not much valued as food," of *T. falcatus*,¹¹ with which our snub-nosed swallowtail is very closely allied, as being "less valuable than its congener *carolinus*."¹² Crossing the Atlantic we find Valenciennes, in his account of *Lichia amia*,¹³ quoting Risso as saying "this fish is highly esteemed and in great request,"¹⁴ while of *Campogramma vadiago*¹⁵ the same author, quoting Rondeletius, reports that "the flesh is rich and well flavored, but tough."¹⁶

Nothing definite is known as to the breeding habits of these fishes, nor have I ever handled a specimen containing spawn in any stage of development. We may, however, fairly assume that, as with all kindred fishes, the ova are shed in the open sea at some distance from the shore and are pelagic.

The swallowtails are of little value from a sportsman's point of view, nevertheless when, as occasionally happens, a large one is hooked in the surf, its great strength, rapidity of movement, and sudden twists and turns are calculated to elicit the highest skill of the angler.

Synopsis of the Trachinotine Genera.

a¹. Maxillary with supplemental bone.

b¹. Teeth in jaws conical and uniserial; anal fin shorter than soft dorsal CAMPOGRAMMA,¹⁷

b². Teeth in jaws in villiform bands; anal fin as long as soft dorsal HYPODIS,¹⁸

a². Maxillary without supplemental bone.

c¹. Thoracic region not cultrate; dorsal and anal fins falciform TRACHINOTUS.

c². Thoracic region cultrate; dorsal and anal fins not falciform ZALOCYS.¹⁹

⁵ Fish. North & Mid. America, pt. i, p. 944.

⁶ Guide to the Study of Fishes, ii, p. 276.

⁷ A substitute name given by Regan (Ann. & Mag. Nat. Hist. (7) xii, p. 349) to *Chaetodon glaucus* Bloch (Ansl. Fisch., iv, 1787, pl. cex), the specific name being antedated by *Scomber glaucus* Linnaeus (Syst. Nat., ed. 10, 1758, p. 298), the two species being congeneric.

⁸ Hist. Nat. Poiss., xiii, p. 407.

⁹ Ibid., p. 941.

¹⁰ Gill, Proc. Acad. Nat. Sci. Phila., 1863, p. 85.

¹¹ *Labrus falcatus* Linnaeus, ibid., p. 284.

¹² Ibid., p. 942.

¹³ *Scomber amia* Linnaeus, ibid., p. 299.

¹⁴ Ibid., p. 357.

¹⁵ *Centronotus vadiago* Risso, Ichth. Nice, p. 196.

¹⁶ Ibid., p. 365.

¹⁷ *Campogramma* Regan, Ann. & Mag. Nat. Hist. (7) xii, 1903, p. 3. Type, *Centronotus vadiago* Risso 1810. Range, Mediterranean and the neighboring parts of the Atlantic. Monotypic.

¹⁸ *Hypodis* Rafinesque, Anal. Nat., 1815, p. —. Type, *Scomber amia* Linnaeus 1758. Range, Mediterranean and Eastern Atlantic. Monotypic.

¹⁹ *Zalocys* Jordan & McGregor, Rep. U. S. Fisher. Comm., 1899, p. 276. Type, *Z. stilbe*, idd., ibid., p. 277. Range, Eastern Tropical Pacific (Revillagigidos). Monotypic.

TRACHINOTUS Lacépède.

Trachinotus Lacépède, Hist. Nat. Poiss., iii, 1802, p. 79 (*falcatus*); Jordan & Evermann, Fish.

North & Mid. Amer., pt. i, 1896, p. 939.

Cæsiomorus Lacépède, ibid., p. 95 (*bailloni*).

Acanthinion Lacépède, ibid., iv, 1802, p. 500 (*rhomboides*=*falcatus*).

Baillonus Rafinesque, Anal. Nat., 1815 (*bailloni*).

Doliodon Girard, Proc. Acad. Nat. Sci. Phila., 1858, p. 168 (*carolinus*).

Bothrolæmus Holbrook, Ichth. South Carolina, 1860, p. 82 (*pampanus*=*carolinus*).

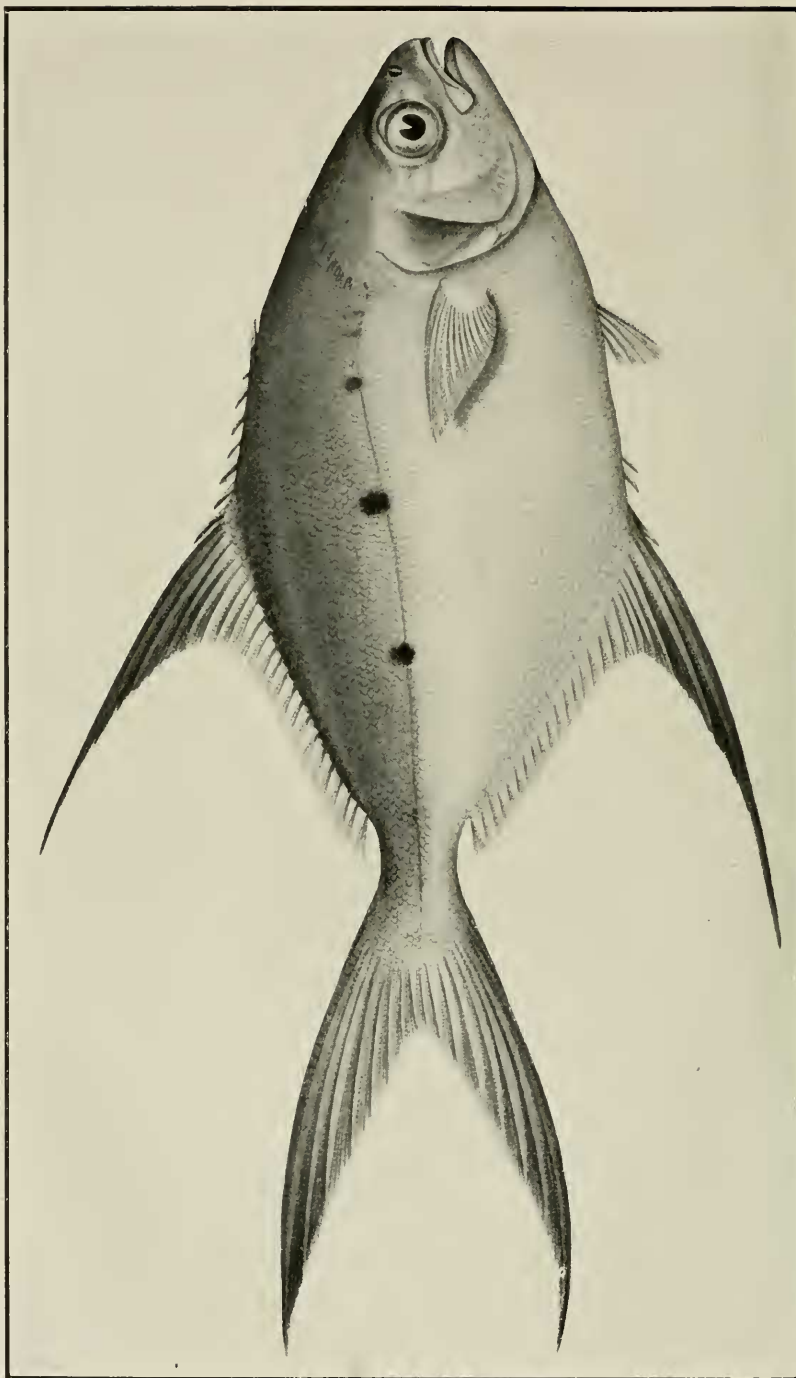
Trachynotus Günther, Brit. Mus. Catal. Fish., ii, 1860, p. 480; amended orthography. Pre-occupied in *Coleoptera* by Latreille in 1829 and in *Hymenoptera* by Gray 1829.

"THE SWALLOWTAILS."

Body ovate or elevated, more or less strongly compressed; abdomen rounded, shorter than the anal fin. Scales small, smooth, and adherent, covering the breast. Lateral line complete, straight or but little curved, sometimes locally undulous. Head rather small, with moderate, truncate or rounded snout, scaleless or partially scaly. Mouth protractile, with rather small, horizontal or slightly oblique cleft, the jaws subequal; maxillary without distinct supplemental bone. Jaws, vomer, and palatines with bands of villiform teeth, disappearing usually with age. Opercles entire in the adult, the young with strong preopercular armature. Two dorsal fins, the first of 6 or 7 spines with an anterior procumbent spine; in the young the former are connected by membrane, but with advancing age this gradually disappears leaving each free, while in very old examples even these are absorbed; soft dorsal and anal fins similar in form and size, the anterior rays in each more or less produced; two stout semi-detached spines in front of the anal, disappearing with age. Caudal deeply forked. Pectoral small, with 17 or 18 rays, the upper the longest. Ventrals small and close together, with 15 rays, inserted below or behind the base of the pectorals. Gill-openings wide; gill-membranes separate, free from the isthmus; branchiostegals seven; pseudobranchiæ present, concealed in old examples; gill-rakers in moderate number, well developed or short; pharyngeal bones strongly armed in the young, the teeth caducous; third upper pair and lower pair closely in contact but not united. (τραχίς, rough; νότος, back.)

Carangoid fishes of moderate or large size, inhabiting all warm seas; about 25 valid species.

Remarkable changes of form and structure take place in these fishes between youth and age. Very young examples have the angle of the preopercle armed with 3 strong spines, and the limbs, both vertical and horizontal, more feebly denticulated; the jaws, vomer, palatines, and pharyngeals toothed; and the spinous dorsal developed as a normal fin. In the second, or *Doliodon*, stage the preopercular spines have been absorbed into the body of the bone, and the relative values of the spinous and soft dorsal fins undergo a reciprocal change, the decrease in the former being counterbalanced by a corresponding increase in the latter. When the half-grown, or *Trachinotus*, stage has been reached, the connecting membrane between the dorsal spines has disappeared, and the functional value of the teeth has perceptibly diminished. In the last, *Bothrolæmus*, stage the teeth both of the mouth and the gullet, the pseudobranchiæ, and the spinous dorsal and anal fins have quite disappeared, while the lobes of the soft dorsal, anal, and caudal fins have attained their maximum development.



TRACHINOTUS BAILLONI (Lacépède). ♂ Nat. Size.

Phyllis Clarke, del.

*Synopsis of Subgenera and Species.**Trachinotus* :—

a¹. Body elevated, its depth half or more than half its length ; snout high, anteriorly vertical ; upper jaw the longer ; gill-rakers short and stout.

b¹. Dorsal fin with 18 or 19, anal with 17 soft rays ; sides immaculate .. 1. *ovalus*.

Cæsiomorus :—

a². Body ovate, its depth less than half its length ; snout low, anteriorly rounded ; gill-rakers longer and more slender.

c¹. Dorsal with 23 or more, anal with 21 or more soft rays.

d¹. Snout slightly gibbous anteriorly ; caudal fin longer ; ventral shorter .. *bailloni*.

d². Snout pointed anteriorly ; caudal fin shorter ; ventral longer *botla*.

c². Dorsal with 20 or less, anal with 17 or less soft rays ; snout gibbous .. *anak*.

TRACHINOTUS BAILLONI (Lacépède).

(Plate XVIII.)

Cæsiomorus bailloni Lacépède, Hist. Nat. Poiss., iii, 1802, p. 93, pl. iii, fig. 1 (after Commerçon's figure).

Cæsiomorus quadripunctatus Rüppell, Atlas Fisch. Roth. Meer., 1828, p. 90, pl. xxiv, fig. 1.

Trachinotus bailloni Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 1831, p. 434 (after Commerçon's MSS.) ; Bleeker, Nat. Tijds., Nederl. Ind., iii, 1852, p. 237 ; id., Verh. Batav. Gen., xxiv, 1852, Makreel., p. 46 ; id., Nat. Tijds. Nederl. Ind., x, 1856, p. 469 ; id., ibid., xii, 1857, p. 214 ; id., ibid., xiii, 1857, p. 419 ; id., ibid., xvii, 1859, p. 146 ; id., Aet. Soc. Sci. Indo-Neerl., viii, 1860, Sumatra. p. 2 ; id., ibid., Celebes. p. 38 ; id., Nat. Tijds. Nederl. Ind., xxii, 1861, p. 65 ; id., Versl. Akad. Amsterdam, xii, 1861, p. 74 ; Steindachner, Denk. Akad. Wien., 1902, p. 22 ; Waite, Rec. Austr. Mus., v, 1903, p. 25 ; id., ibid., 1904, p. 200 ; Jordan & Seale, Bull. U. S. Bur. Fisher., xxv, 1906, p. 235 ; Jordan & Starks, Proc. U. S. Nat. Mus., xxxii, 1907, p. 495 ; Jordan & Richardson, Mem. Carnegie Mus., iv, pt. 4, 1909, p. 180 ; id., Check-List Fish. Philipp Archip., 1910, p. 21 ; Kendall & Goldsborough, Mem. Mus. Comp. Zool., xxvi, 1911, p. 271, pl. ii, fig. 1 ; McCulloch, Rec. W. Austr. Mus., i, pt. 3, 1914, p. 223.

Trachinotus quadripunctatus Cuvier & Valenciennes, ibid., p. 434.

Trachynotus quadripunctatus Cantor, Catal. Malay. Fish., 1850, p. 122.

Trachynotus bailloni Günther, Brit. Mus. Catal. Fish., ii, 1860, p. 484 (descr. & synonym. in part) ; Bleeker, Versl. Akad. Amsterdam, xiv, 1862, p. 109 ; id., Nederl. Tijds. Dierk., i, 1862, p. 242 ; id., Versl. Akad. Amsterdam, xvi, 1864, p. 260 ; id., Nederl. Tijds. Dierk., ii, 1865, pp. 99, 174, 191, 289 ; Playfair, Proc. Zool. Soc. London, 1867, p. 861 ; Klunzinger, Verh. zool.-bot. Ges. Wien., 1871, p. 449 ; Bleeker, in Pollen & van Dam, Faun. Madagascar, pt. 4, 1875, Poiss., p. 98 ; Day, Fish. India, pt. 2, 1876, p. 233, pl. lia, fig. 4 ; Peters, Mon. Akad. Berlin, 1876, pp. 440, 836 ; Bleeker, Verh. Akad. Amsterdam, xviii, 1879, Ile Maurice p. 18 ; Macleay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 545 (descr. after Günther ; not localities) ; Boulenger, Proc. Zool. Soc. London, 1887, p. 661 ; Waite, Mem. Austr. Mus., iii, pt. 8, 1897, p. 190.

Trachynotus bailloni Day, Proc. Zool. Soc. London, 1865, p. 25 ; id., Fish. Malabar, 1865, p. 98 ; Günther, Fisch. d. Sudsee, pt. 4, 1876, p. 139.

Trachinotus oblongus Kendall & Goldsborough, ibid., p. 272, pl. i. Not of Cuvier & Valenciennes 1831.

BLACK-SPOTTED SWALLOWTAIL.

Type localities :—Fort Dauphin, Madagascar (*C. bailloni*).

Red Sea at Massawa (*C. quadripunctatus*).

Body ovate and strongly compressed, the ventral contour rather more curved than the dorsal, which is linear and moderately acclivous from the forehead to the nape, beyond which the acclivity is much more gentle to the soft dorsal ; ventral contour moderately convex from the chin to the anal with

a slight emargination at the isthmus; width of body 4 in its depth, which is 2.3 to 2.45 in its length and five ninths to two thirds more than the length of the head; abdominal region moderate, 1.67 in the length of the anal; caudal peduncle about three fifths longer than deep, its least depth three tenths more than the eye-diameter. Head rather small, its length 3.8 in that of the body, its width 1.8 in its depth, which is 1.1 in its length; cranio-nuchal keel little developed. Snout moderate and rounded, its upper profile linear and oblique, with a slight prefrontal prominence, its length one eighth more than the eye-diameter, which is 3.85 to 4 in the length of the head; adipose lid little developed; interorbital region elevated and sharply rounded, its width three eighths more than the eye-diameter. Jaws equal; maxillary extending to below the anterior border of the pupil; its length 2.75 in that of the head, the width of its concave distal extremity two thirds more than its distance from the eye and 2.55 in the eye-diameter. Preopercle with rounded angle, the membranous border feebly crenulate, the hinder limb vertical.

Both jaws with a band of villiform teeth; similar teeth on the vomer and palatines; pterygoids and tongue smooth.

Scales small and rounded on the trunk, becoming gradually larger on the tail; cheeks and postorbital region scaly; rest of head and nuchal ridge naked. Lateral line with a feeble curve anteriorly, thence straight to the caudal fin, the pores about 95.

Dorsal fin with vi, i 23 or 24 rays; procumbent spine strong and exposed; spines short and separate, graduated, the last 1.4 in the eye-diameter. Soft dorsal originating one fifth nearer to the root of the caudal than to the tip of the snout, the anterior rays produced, the first the longest, varying from 2.25 to 3.2 in the body-length, and extending when depressed to the base of the 19th ray or the middle of the caudal peduncle; last ray not produced. Caudal fin very long and deeply forked, the lobes pointed, the upper rather the longer, 1.95 to 2.15 in the length of the body. Anal fin with ii, i 23 rays, originating a little in advance of the soft dorsal, its lobe as high as that of the dorsal. Pectoral pointed, with 17 rays, its length 5.5 in that of the body; 4th ray longest, extending to a little beyond the level of the vent. Ventral small, inserted slightly behind the pectoral-base, its length 1.75 to 1.85 in that of the pectoral and 9 to 9.75 in that of the body; 1st and 2nd rays equal, reaching to the vent.

Gill-rakers rather short and moderately strong, 7+16 on the anterior arch, the longest 8.2 in the length of the head and as long as the gill-fringes. Vent midway between the origins of the ventrals and anal.

Upper surface of head and body greenish gray, shading through the silver-gray of the sides to the milk-white of the lower surface; a series of four round spots on each side upon the lateral line; the first faint, situated upon the curve, below the procumbent spine; the second larger and darker, below the 3rd and 4th spines; the third rather larger, below the anterior dorsal rays; the last much smaller and fainter, below the middle of the soft dorsal.²⁰ Dorsal and anal lobes and the outer edge and tip of the upper caudal lobe blackish. (Named after L. A. J. Baillon, an early French naturalist.)

Described from one of two specimens collected by Mr. McCulloch at Murray Island, these being at present the only authentic examples known from Australian

²⁰ On the left side the arrangement of the spots is similar, but all are appreciably further back.

waters. On this account the gift of one for the purpose of this work by the authorities of the Australian Museum is the more commendable, and our thanks proportionately the greater.

Historical.—The earliest published notice of this species is that of Lacépède, whose description was taken from a drawing by Commerçon, which he also reproduced. This specimen was captured at Fort Dauphin, Madagascar as we learn from Valenciennes who, more fortunate than his predecessor, was able to draw up his description direct from certain Commerçonian manuscripts, which were not available to Lacépède. Meanwhile, however, under the name of *Casiomorus quadripunctatus*, Rüppell had described and figured the same species from the port of Massawa on the Abyssinian littoral of the Red Sea. Under this specific name Valenciennes records it separately from examples obtained by Dussumier in the Seychelles Archipelago, but he is careful to point out its close resemblance to *Trachinotus bailloni*. After an interval of nearly twenty years we find our fish in evidence as occurring in the "Sea of Pinang"²¹ where, according to Cantor, "a single individual was taken in June, 1845, while unusually strong southerly winds prevailed." His specimen measured 197 millim. and was, so the local fishermen asserted, "of very rare occurrence." A couple of years later Bleeker announced the receipt of specimens from Ceram, which eventually proved to be the most easterly point from which he received it, and from that time on records of its occurrence in various islands of the Malay Archipelago became frequent. The publication of the British Museum Catalogue of Fishes in 1860 provided an important increase in the eastern range of the species, Dr. Günther being in a position to announce that the National Museum had acquired, through the medium of the Museum of Economic Geology, a fine specimen from Tanna, one of the larger islands in the southern half of the New Hebrides Group.²² In 1865 Bleeker enlarged its distribution northward to the Coast of Siam and Day recorded it from Cochin on the Malabar Coast of India. Day's record is, however, more or less impaired by his inability at that time to distinguish between these two closely allied species; his synonymy (Fishes of Malabar) indubitably includes both species, but his description of the position of the lateral spots, i.e.—"on the lateral line there are four or five large black spots more or less distant, the first one opposite the end of the pectoral," as undoubtedly refers to this species. His account of the habits might have been penned as a description of those of *T. botla* as we know them on our own shores, and doubtless applies with equal justice to either species. He writes—"This fish is uncommon, and is usually captured by cast-nets in the surf, where the fishermen assert it always swims; it is very rarely taken in the deep sea and never in the rivers." Eleven years later, when the second part of his Fishes of India was produced, we find that he has altered his opinion as to the validity of the two species, of both of which he gives a recognisable figure and description. Leaving out the question of coloration he relies principally for the separation of the species—on the smaller number of anal rays, the longer ventral fins, and the shorter caudal fin in *T. botla* than in *T. bailloni*. If we attempt a general analysis of these three characters from the specimens to which we have access we

²¹ The island of Pulo Pinang or Prince of Wales Island, to which this refers, lies off the West Coast of the Malay Peninsula in lat. 5° N.

²² Since Jordan & Seale (Fishes of Samoa, p. 235) deny by implication the presence of *T. russellii* (= *botla*) in any of the islands of the South Pacific, it follows that in all probability this is a true *T. bailloni*.

find that none of the three is of any differential value, but if on the contrary we select from each species a single example of practically the same size we find that, while the first character should be discarded as useless, the other two hold good absolutely. For instance, comparing a 148 millim. *bolla* with a 155 millim.²³ *bailloni*, we see that these characters compare as follow—Length of ventral fin to body-length, *T. bolla* 7.9, *T. bailloni* 9.55; length of caudal fin in same, *T. bolla* 2.5, *T. bailloni* 2.15. So far, therefore, as this method of comparison goes, Day's conclusions are fully justified.²⁴ In the interval between the publication of these two works, Playfair in 1867 had obtained our species at the Seychelles. In 1876 Günther, still persisting in his refusal to recognise the distinction between the two species, again makes a notable addition to the eastern range of this trachinote, recording it from Samoa and even, on the authority of Garrett, as far east as the Society Islands, while Peters in the same year added New Britain to the list. Bleeker, in one of the last papers of his busy life, records it from Mauritius, and Boulenger some years later received it from Maskat on the Persian Gulf, neither of these localities, however, adding anything to its range. We next hear of it through the Expedition sent out in 1896 by the Royal Society of London to Funafuti, where Hedley succeeded in collecting for the Australian Museum a very young example, measuring but 85 millim. in total length, as recorded by Waite. This record is interesting as indicating a new radial of range, stretching outwards about one thousand miles north-eastwards from Tanna. Waite was also fortunate in obtaining a large example, measuring 560 millim. over all, from Lord Howe Island through the kind offices of Mr. W. S. Thompson; both of our spotted swallowtails are, therefore, visitants to the "Madeira of the Pacific." Previous to this Steindachner had added Socotra and the coast of South Arabia to the list of known localities. Jordan and Seale had nothing new to advance as to its Pacific distribution, but the senior author in conjunction with Starks obtained a single specimen "a little deeper in form than is usual in this species" from the Riu Kiu Archipelago (Loo Choo Islands), which up to the present time constitutes the northern limit of its distribution. Subsequently Formosa and the Philippines were added by Jordan and Richardson. In a paper published in 1911,²⁵ dealing with the Shore Fishes collected by the Albatross Expedition to the Tropical Pacific in 1899-1900 Kendall and Goldsborough attempt to review the status of the Indo-Pacific spotted trachinotes. These authors commence with a criticism of Day's figure of *T. bailloni* as regards the extension of the maxillary: this criticism is fully justified, but the illustrations in the "Fishes of India" are so frequently inaccurate in matters of detail, that it is questionable whether this particular inaccuracy, neutralised as it is by a correct description, merits the prominence given to it. The authors proceed then to discuss the length of the vertical fin lobes, a character on which far too much importance is placed, for the variation in this respect is very great even in a single species and, as I have shown before,²⁶ is not contingent on the size or age of the individual, and is, therefore, of no structural value. The measurements given by them are also most confusing; in some cases those of the lobes are given "in length," in others "in base of fin," so that there is no standard of comparison, and, therefore, no

²³ From tip of snout to root of caudal fin.

²⁴ Fishes of Malabar 1865 and Fishes of India 1876.

²⁵ I was unfortunately unaware of this paper when I wrote the article on *T. bolla* in last year's Memoirs.

²⁶ Memoirs Queensl. Mus., iii, p. 96.

general comparison between specimens of different sizes is possible. Again, the measurements given "in length" would make it appear at a casual glance that the lobes are excessively short, in fact practically non-existent, but on turning to the figure (of *T. oblongus*) we find that the caudal fin is included in the "length" measurement, a method of computation which has been discarded for so many years by all reputable ichthyologists, that it is necessary here to call attention to its revival in a modern work. Measured in the ordinary manner, from the tip of the snout to the root of the caudal, their figure agrees very well with my example of *T. bailloni*, in the synonymy of which their *T. oblongus* should be placed, while their *T. quadripunctatus* should be relegated to *T. botla*. Reverting for a moment to these authors' criticism of the inaccurate representation of the maxillary in Day's figure, it is somewhat disconcerting to find that while they write of that bone in *T. oblongus* as "maxillary short, reaching front of eye," their artist has depicted it as reaching well-nigh below the middle of the eye, thus reversing their own proposition.

Uses.—The only notice which I can find, dealing with this important phase of the subject, is that by Valenciennes, under *Trachinotus quadripunctatus*, where he writes in reference to the Seychelles islanders "it is highly esteemed and is moderately abundant throughout the year." Doubtless my remarks under *T. botla* would apply with equal justice to this fish, as also those regarding their food.

Range.—The range of the Black-spotted Swallowtail is much wider than that of its congener and near ally *T. botla*, being roughly from Madagasear, Mauritius, the Seychelles, and the Red Sea, through the Indian and Malayan seas eastward to the Ellice and Society Islands and northward to the Riu Kiu Group. In Australian waters the records, as before mentioned, are very unsatisfactory, owing to the association of the two allied species—*botla* and *bailloni*—under the latter name by Dr. Günther, whose example was followed by all the earlier Australian writers. Two records may, however, be selected, the one as certainly, the other as probably, authentic. The first relates to the specimens collected by McCulloch at Murray Island, the second to that recorded by Waite from Lord Howe Island; the latter is unfortunately unavailable for re-examination. Eastward of Australia it has been specifically reported from—Lord Howe Island (*Waite*), New Britain (*Peters*), New Hebrides, Samoa, and the Society Group (*Günther*), and the Ellice Islands (*Waite*). It may, therefore, be regarded as of general distribution among the greater number if not all of the South Sea Islands. Turning westward from thence we first note the Murray Island record (*McCulloch*), and next arrive at the Austro-Malayan section of the Archipelago, whence it has been recorded from Ceram, Amboina, Batehian, Obi, and Celebes (*Bleeker*), while the Indo-Malayan section yielded to the same indefatigable collector specimens from Bali, Java, Nias, and Sumatra. Northwards we find it extending through the Philippines and Formosa (*Jordan & Richardson*) to the Riu Kiu Islands (*Jordan & Starks*), but so far it does not seem to have reached Japan, nor to have been met with on the mainland of China. Westward from the Malay Archipelago it recurs at Pulo Pinang (*Cantor*), Siam (*Bleeker*), and the Indian Peninsula (*Day*), onward through the Persian Gulf (*Boulenger*) to Socotra and South Arabia (*Steindachner*), which lie at the gateways of the Red Sea, one of the original type-localities (*Rüppell*). Southwards in the Indian Ocean it has been recorded from the Seychelles (*Valenciennes*), Mauritius (*Bleeker*), and Madagasear (*Commerçon*), but I can nowhere find any notice of its occurrence on the East African littoral.

Dimensions.—Day obtained a specimen measuring 483 millim. on the Indian Coast, but Waite's Lord Howe Island record of 559 millim. is, I believe, the highest as yet published.

Illustration.—Through the kindness of the Trustees of the Australian Museum our illustration has been taken from the larger and more perfect specimen taken by Mr. McCulloch at Murray Island.

TRACHINOTUS OVATUS (Linnaeus).

Pesque-pampus Renard, Poiss. Moluques, i, 1718, pl. xxvii, fig. 151.

Ikan-botoe Valentyn, Amboina, iii, 1724, p. 386, fig. 118.

Gasterosteus oratus Linnaeus, Syst. Nat., ed. 10, i, 1758, p. 296; Bonnaterre, Encycl. Méth., Ichth. 1788, p. 137.

Scomber falcatus Forskal, Deser. Anim., 1775, p. 57; Bonnaterre, *ibid.*, p. 142. Not *Labrus falcatus* Linnaeus, which is also a *Trachinotus*.

Trachinotus falcatus Lacépède, Hist. Nat. Poiss., iii, 1802, p. 79; Rüppell, Atlas Fisch. Roth. Meer., 1828, p. 89; Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 1831, p. 430. Not *Labrus falcatus* Linnaeus.

Casiomorus blochii Lacépède, *ibid.*, p. 95, pl. iii, fig. 2 (after Commerçon's figure).

Centronotus ovalis Lacépède, *ibid.*, pp. 309, 316.

Mookalee Parah Russell, Fish. Vizagapatam, ii, 1803, p. 39, pl. cliv.

Trachinotus mookalee Cuvier & Valenciennes, *ibid.*, p. 423; Bleeker, Nat. en Geneesk. Arch. Nederl. Ind., ii, 1845, p. 516; *id.*, Verh. Batav. Gen., xxiii, 1850, Midd.-en Oost-Java, p. 8; Jerdon, Madras Journ. Lit. & Sci., 1851, p. 136; Bleeker, Nat. Tijds. Nederl. Ind., iii, 1852, pp. 412, 445; *id.*, Verh. Batav. Gen., xxiv, 1852, Makreel., p. 47; *id.*, *ibid.*, xxv, 1853, Bengal, p. 44; *id.*, Nat. Tijds. Nederl. Ind., xv, 1858, pp. 223, 459; *id.*, Aet. Soc. Sci. Indo-Neerl., v, 1858, Borneo, p. 2; *id.*, *ibid.*, viii, 1860, Sumatra, p. 28; *id.*, *ibid.*, Borneo, p. 13; *id.*, *ibid.*, Celebes, p. 38.

Trachinotus blochii Cuvier & Valenciennes, *ibid.*, p. 429 (after Commerçon's MSS.); Bleeker, Versl. Akad. Amsterdam, xii, 1861, pp. 52, 74.

Trachinotus affinis Cuvier & Valenciennes, *ibid.*, p. 428.

Trachinotus falciger Cuvier & Valenciennes, *ibid.*; Bleeker, Nat. en Geneesk. Arch. Nederl. Ind., ii, 1845, p. 516.

Trachinotus drepanis Cuvier & Valenciennes, *ibid.*, p. 429.

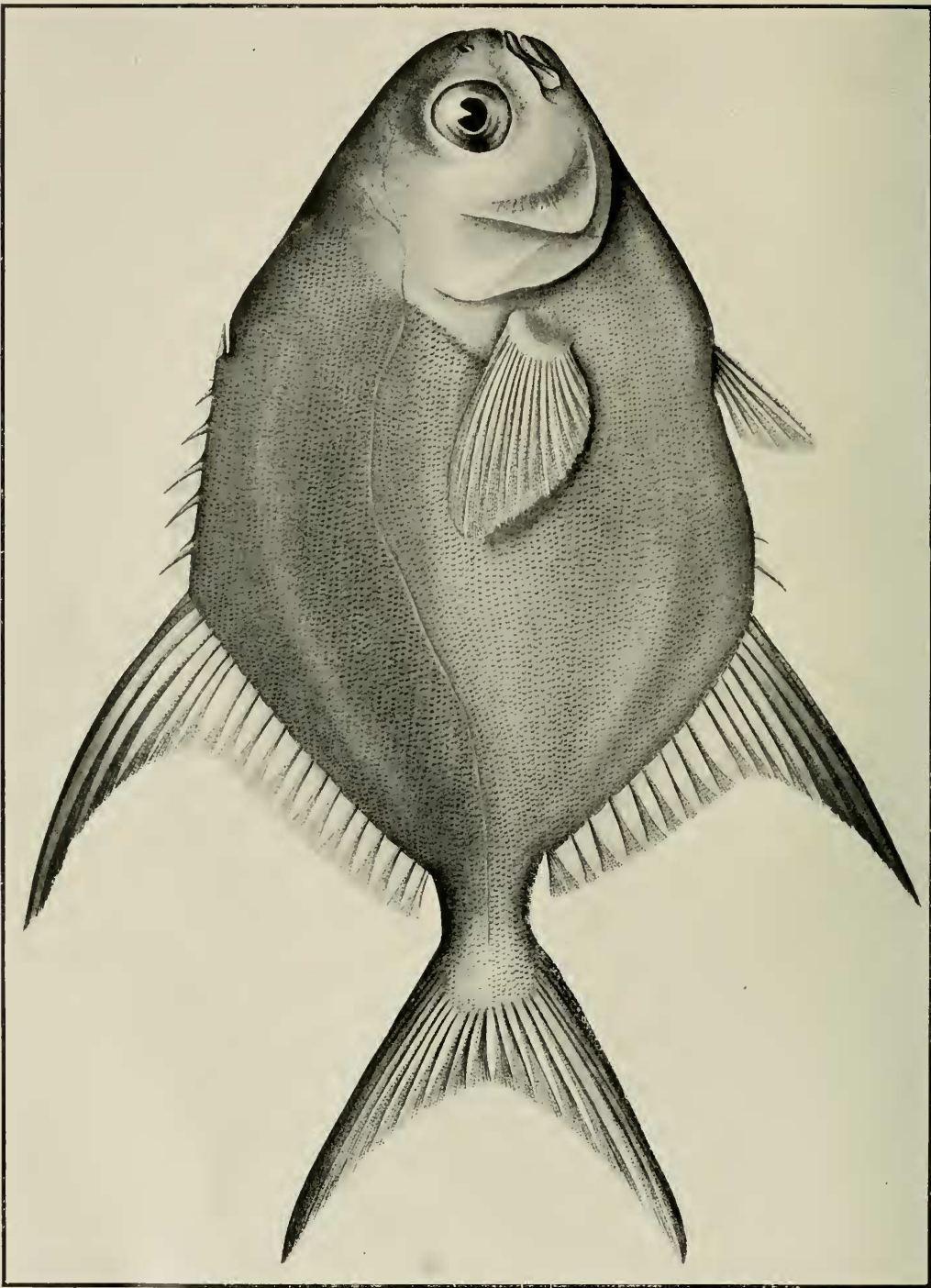
Trachinotus auratus Richardson, Rep. Ichth. China & Japan, 1845, p. 270.

Trachinotus mookalee Cantor, Catal. Malay. Fish., 1850, p. 120.

Trachinotus oratus Günther, Brit. Mus. Catal. Fish., ii, 1860, p. 481; Bleeker, Nederl. Tijds. Dierk., i, 1863, p. 242; *id.*, *ibid.*, ii, 1865, p. 289; Day, Proc. Zool. Soc. London, 1865, p. 25; *id.*, Fish. Malabar, 1865, p. 97; Kner, Reise Novara, Fisch., pt. 2, 1865, p. 164; Playfair, Proc. Zool. Soc. London, 1867, p. 861; Steindachner, Sitz. Akad. Wien, lx, 1869, p. 709; Day, Proc. Zool. Soc. London, 1870, p. 689; Klunzinger, Verh. zool.-bot. Ges. Wien, 1871, p. 449; Bleeker, Nederl. Tijds. Dierk., 1873, p. 132; *id.*, in Pollen & van Dam, Faun. Madagascar, pt. 4, 1875, Poiss. p. 98; Day, Fish. India, pt. 2, 1876, p. 234, pl. lib, fig. 2; Günther, Fisch. d. Sudsee, pt. 4, 1876, p. 139; Alleyne & Madeay, Proc. Linn. Soc. N. S. Wales, i, 1877, p. 329; Klunzinger, Sitz. Akad. Wien, lxxx, i, 1879; Günther, Zool. Challenger, i, 1880, Shore Fishes, p. 44; Madeay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 545 (after Günther); *id.*, *ibid.*, vii, 1882, p. 359; Woods, Fish. & Fisher. N. S. Wales, 1882, p. 17; Ogilby, Catal. Fish. N. S. Wales, 1886, p. 27.

Trachinotus oratus Steindachner, Denk. Akad. Wien, 1902, p. 22; Waite, Synops. Fish. N. S. Wales, 1904, p. 41; Jordan & Seale, Bull. U. S. Bur. Fisher., xxv, 1906, p. 235; Stead, Edib. Fish. N. S. Wales, 1908, p. 93; Jordan & Richardson, Mem. Carnegie Mus., iv, 1909, p. 180; Kendall & Goldsborough, Mem. Mus. Comp. Zool., xxvi, 1911, p. 271.²⁷

²⁷ Jordan & Gilbert (Proc. U.S. Nat. Mus., v, 1882, p. 375) record the species from Western America, but I can not find any mention of this reference in the Fishes of North and Middle America; possibly it should be placed in the synonymy of the closely allied *T. culveri*.



TRACHINOTUS OVATUS (Linnaeus). 1½ Nat. Size.

Phyllis Clarke, del.

SNUB-NOSED SWALLOWTAIL.

Snub-nosed Dart (*Stead*).

(Plate XIX.)

Type localities:—"In Asia" (*G. ovatus*).Red Sea at Jeddah (*S. falcatus*).Fort Dauphin, Madagasear (*C. blochii*).Pondicherry (*T. mookalee*).Malabar Coast (*T. affinis*).Malabar Coast (*T. falciger*).Seychelles (*T. drepanis*).

Body deeply ovate and strongly compressed, the dorsal contour much more arched than the ventral; the former linear or feebly convex and strongly acclivous from above the nostrils to the tip of the procumbent spine, the latter linear and declivous from the chin to the isthmus thence convex to the vent, which is situated in a slight concavity; width of body 3.35 to 3.5 in its depth, which is 1.75 to 2 in its length and one and three fourths times to twice the length of the head; abdominal region moderate, 1.25 to 1.35 in the length of the anal; caudal peduncle from three tenths to five ninths longer than deep, its least depth from a little less to a little more than the eye-diameter. Head small, its length 3.3 to 4 in that of the body, its width 1.95 to 1.8 in its depth, which is slightly more than its length; cranio-nuchal keel moderate to weak. Snout short and blunt, deeper than long, its anterior profile sloping somewhat backwards in the young, vertical in the adult, its length 1.25 to 1.1 in the eye-diameter, which is 3 to 3.5 in the length of the head; adipose lid little developed; interorbital region elevated and strongly convex, its width from one fifth to one half more than the eye-diameter and 2.2 to 2.67 in the length of the head. Upper jaw slightly projecting; maxillary extending to below the anterior border of the pupil, its length 2.9 to 3.35 in that of the head, the width of its rounded distal extremity subequal to its distance from the eye and 3.33 to 4.67 in the eye-diameter. Preopercular angle broadly rounded and somewhat produced, the membranous border entire, the hinder limb inclining slightly forwards.

Jaws, vomer, and palatines with bands of minute teeth in the young, which gradually disappear with advancing age, the adults toothless.

Scales small, thin, and deeply embedded, ovate, increasing slightly in size posteriorly; entire head and nuchal ridge naked. Lateral line curved upwards above the base of the pectoral, thence descending in a long, shallow, often irregularly undulated curve to below the middle of the soft dorsal, thence straight, the pores about 130.

Dorsal fin with vi, i 18 to 20 rays; spines short and stout, united by membrane in the young, separate in the adult, evenly graduated from the front, the last 1.75 to 1.25 in the eye-diameter; procumbent spine strong and exposed; soft dorsal originating from one third to one sixth nearer to the root of the caudal than to the tip of the snout, the anterior rays produced, the first the longest, 2 to 3 in the body-length, and extending when depressed to between the anterior fifth of the caudal and the base of the 14th dorsal ray; last ray not produced. Caudal fin long and deeply forked, the lobes acute and of equal length, 2.75 to 2.5 in the length of the body. Anal fin with ii, i 16 or 17 rays,

originating below the 7th dorsal ray; 2nd spine longest, 1.85 to 1.55 in the eye-diameter; anal lobe lower than that of the soft dorsal, 2.7 to 3.8 in the body-length, and extending when depressed to between the middle of the peduncle and the base of the 13th ray. Pectoral pointed, with 19 rays, its length 4.25 to 4.67 in that of the body; 5th ray longest, reaching in the young to above the 1st anal spine, in the adult to above the vent. Ventral moderate, inserted well behind the pectoral, its length 1.4 to 2.15 in that of the pectoral and 6 to 10 in the body-length; outer ray longest, extending somewhat beyond or to the vent.

Gill-rakers short, $6 + 9$ on the anterior arch, the longest 9.5 to 16 in the length of the head. Vent about one sixth nearer to the anal than to the origin of the ventral. Pyloric appendages 12 to 14.

Glaucous above, the sides silvery; cheeks, throat, abdomen, and lower surface silvery in the young, golden in the adult. Dorsal and upper caudal lobes greenish brown; shorter rays of dorsal and anal pale reddish brown with a lighter border; lower caudal and anal lobes and ventrals golden; pectoral glaucous; iris silvery. (*ovatus*, egg-shaped.)

Described from 4 specimens, measuring respectively 140, 181, 247, and 375 millim.; two of these belong to the Queensland Museum and two to the Amateur Fishermen's Association, by whom they were kindly lent to me. The smallest was obtained from Raine Island and was donated by the Wanetta Pearl Company; the second was collected at Darnley Island by Dr. J. R. Tosh; the two others are from Moreton Bay.

Historical.—The Snub-nosed Swallowtail was known to the older Dutch voyagers who sought fortune in the Indies, and opened up the riches of the Spice Islands to the trade of Europe; whose discoveries were in fact the precursors of our own countrymen's still greater achievements in those bygone days, when human ingenuity, badly equipped but indomitable, pitted its weakness against the forces of nature and the unknown in its ceaseless struggle to elucidate the secrets of the mysterious Orient. Under the name of "pesque-pampus" Renard gave us the earliest figure of this species in his work on the Fishes and Crustaceans "*que l'on trouve autour les Isles Moluques et sur les côtes des Terres Australes.*" This figure was reproduced by Valentyn in his account of Amboina. In 1858 Linnaeus briefly described it from Asiatic examples as *Gasterosteus*²⁸ *ovatus*, and in this erroneous position it remained through all the subsequent editions of the *Systema Naturæ* up to Dr. Turton's English translation in 1806. Thirty years before this Forskal had, however, more correctly assigned this fish to the Linnaean genus *Scomber*—with which in his time the bulk of the present-day carangids were associated—under the appropriate name of *S. falcatus*, his

²⁸ The Linnean genus *Gasterosteus* originally contained eight species, and included besides the present fish such diverse forms as the Pilot-fish (*Naucratus ductor*) carangid, a featherfins (*Pterois volitans*) scorpenid, and a flying gurnard (*Cephalacanthus spinarella*),^a as well as the sticklebacks, to which the name is now restricted.

^a This appears to me to be the correct name of the Atlantic species, which Regan (Ann. & Mag. Nat. Hist. (8) xi, 1913, p. 183) calls *Dactylopterus volitans*. *Cephalacanthus* Lacépède has page precedence over the same author's *Dactylopterus*, while *Gasterosteus spinarella* Linnaeus (p. 297) is five pages earlier than *Trigla volitans* (p. 302). The mistake seems to have arisen through confusing Linnaeus' *Gasterosteus volitans* (p. 296), which is our *Pterois volitans*, with his *Trigla volitans*, which is the present species. Jordan & Richardson (Proc. U. S. Nat. Mus., xxxiii, p. 665) have fallen into the same trap.

specimens having been taken at Jeddah and Lohaia on the Arabian shore of the Red Sea. In no event, however, could this name have stood, for Linnæus' *Labrus falcatus*, from the East Coast of the Americas, is also a *Trachinotus*, and so closely allied to the present species that Günther united them under the earlier name *ovatus*. Lacépède, in the third volume of his *Histoire Naturelle*, described the species by no less than three distinct generic and specific names. He first proposed the genus *Trachinotus*, which is now universally recognised, basing it on Forskal's *Scomber falcatus*, and within a few pages redescribed it as *Casiomorus blochii*, from a drawing by Commerçon of a fish taken at Fort Dauphin, Madagasear. Finally he assigned it to his genus *Centronotus*, of which Linnæus' *Gasterosteus ductor* is the type, as *C. ovalis*. In the following year Russell described and figured it from the Coromandel Coast of India under the name "Mookalee Parah." Rüppell, some twenty-five years later, recorded it under Lacépède's first name from Massawa and observes that it is common in winter. Valenciennes records it under six different names. In his first essay he describes it as *Trachinotus mookalee* from specimens sent to Paris by Messrs. Leschenault from Pondicherry—where, he stated, it was rarely taken but occurred at all seasons of the year—and Dussumier from Malabar, recognising in it Russell's species mentioned above; the reason for the change of name is not, however, apparent, since he correctly identifies that fish with the *Gasterosteus ovatus* of Linnæus. He next notices it as *T. blochii*, stating that his diagnosis is taken from "a more accurate description which we have found in the newly discovered papers of Commerçon." As *T. affinis* and *T. falciger* he redescribed it from specimens collected by Dussumier on the Malabar Coast, and again as *T. drepanis* from a small example obtained by the same collector at the Seychelles, where it was reported as abundant. Finally he recorded it from the Red Sea as *T. falcatus*, his description following those of Forskal and Rüppell. In 1845 Richardson gave it yet another name, *T. auratus*, from examples captured at Canton, noting, however, its close affinity to *T. mookalee*, under which name Cantor records it from the Sea of Pinang, where it appears to be scarce, as he only met with two young examples during his three and a half years' residence there. Up to the date of the issue of the second volume of Günther's Catalogue Bleeker also identified the Malayan fish as *T. mookalee*, under which name he records it from numerous localities, as too he subsequently did under *T. ovatus*. To Dr. Günther belongs the credit of first definitely associating our fish with the Linnæan *G. ovatus*, but he made the mistake of uniting the Atlantic and Indo-Pacific species, which are better kept separate, the former as *T. falcatus*, the latter as *T. ovatus*, though it must be allowed that the differences are but slight.²⁹ Günther mentions a specimen in the British Museum as being from Australia, and this is, so far as I can ascertain, the earliest notice of the species from the seas of the Commonwealth; in the same list he records an example taken by Macgillivray at Aneiteum, New Hebrides. No further information regarding its distribution came to hand until sixteen years later, when Günther, in the *Fische der Südsee*, announced its presence in the Samoan Group on the authority of the Rev. S. J. Whitmee, but added that it was rare

²⁹ Comparing the latest available detailed description of the Atlantic fish (Jordan & Evermann, *Fish. North & Mid. America*, p. 941) with the above I find the following differences:—
 Maxillary extending to below middle of eye, 2·67 in head; anal lobe shorter, about 4·3 in body-length; ventral short, 3 in head *falcatus*.
 Maxillary extending to below anterior border of pupil, 3 in head; anal lobe longer, 3·8 or more in body-length; ventral longer, 2·5 or more in head *ovatus*.

among the South Sea Islands, a remark which subsequent investigations have shown to be correct. The first definite locality attached to an Australian specimen is that established by Alleyne and Macleay in 1877 who, in their account of the Fishes of the Chevert Expedition, recorded its capture at the Percy Islands, M.Q., thus adding this fine fish to our Queensland fauna. Their record was quickly verified by Klunzinger who, two years later, listed it from Cleveland Bay, N.Q., and Günther who, in the following year, recorded it from Somerset, N.Q., from specimens brought back by the Challenger Expedition. Macleay in 1881 gave its Australian distribution as "Port Jackson. All Australian Coasts." I do not know on what grounds he made this sweeping statement, but it is certainly quite unwarranted. As far as Port Jackson is concerned his record is copied from Castelnau,³⁰ whose description refers to *T. botla*, and has unfortunately been passed on by other writers on the New South Wales fishes (Woods, Ogilby, Waite). Personally I do not know of any example which can be unquestionably assigned to the southern State, nor does McCulloch, with whom I communicated on the subject. Stead, however, writes me thus—"I have certainly seen *Trachinotus ovatus* from New South Wales waters, though rarely, and always among consignments of fish coming in from our northern waters." It is certainly not found in Victoria nor Tasmania, and it has not been recorded from either South or West Australia nor from the Northern Territory,³¹ though it is doubtless found in the two last-named areas. Macleay subsequently recorded a specimen from Port Moresby, B.N.G.; Jordan and Richardson obtained it from Formosa, this being the most northerly position from which it has as yet been recorded. Jordan and Seale were unable to add any further South Sea localities to those already known, though they collected three specimens at Samoa, but Kendall and Goldsborough report the capture of a small specimen at Vavau in the Tonga Group.

Uses:—This species is so scarce, at least with us in Southern Queensland, that I am unable to give personal information as to its value as a food-fish. Most of the older writers, however, give it an excellent character. Valentyn's verdict, for instance, is "small but very delicate," a remark which suggests that he did not know the adult fish. Rüppell writes of it as being "very good eating." Both Leschenault and Dussumier reported to Valenciennes that "its flesh is fine and choice." The only discordant note in this chorus of praise was sounded by Russell who tells us, writing of a 20-in. example, that "it is a dry insipid fish," a statement which is retailed without comment by Day who, however, allows that it "smokes well." Taking into consideration its very close relationship to the "pámpano" of the Atlantic, and the very high character for excellence to which that species has attained, I incline to the belief that the snub-nosed swallowtail will prove an acquisition to our tables, when modern methods of capture and distribution have placed it within our reach.

Range:—From the Red Sea southward to Madagascar and the Seychelles, and eastward through the Indian and Malayan Seas to Intertropical Australia, New Guinea, the New Hebridean, Tongan, and Samoan Archipelagos. In

³⁰ Proc. Linn. Soc. N. S. Wales, iii, p. 383.

³¹ Is it not time that this huge tract of land received a distinctive appellation and its baptism as a State? And what more fitting tribute than this could be paid to the memory of one of the greatest of the Empire's sons—Charles Darwin—who visited it in the "Beagle" as long ago as 1836. Floreat Darwinia!

Australian waters it is so far known from the coasts of Queensland and Northern New South Wales (*Stead*) only. In this State it has been recorded from Moreton Bay, S.Q. (*O.C. & Ogilby*).³² Percy Islands, M.Q. (*Alleyne & Macleay*), Cleveland Bay, N.Q. (*Klunzinger*), Somerset, N.Q. (*Günther*). Raine Island, B.R. (*Ogilby*), and Darnley Island (*Tosh*). From British New Guinea it has been sent from Port Moresby (*Macleay*). Passing eastward we find it occurring at Aneiteum and Samoa (*Günther*) and Vavau (*Kendall & Goldsborough*). Turning to the westward, Bleeker received it from the Austro-Malayan Islands of Amboina, Obi, and Celebes, and from the Indo-Malayan Borneo, Biliton, Java, Banca, Sumatra, Pinang, and Cocos. It has been recorded from Formosa (*Jordan & Richardson*), Macao (*Richardson*), China (*Bleeker*), and the Andamans (*Day*), is common on both sides of the Indian Peninsula, whence it ranges westward to South Arabia (*Steindachner*) and the Red Sea, and south-westward to the Seychelles (*Dussumier*) and Madagascar (*Commerçon*).

Dimensions:—My largest example measured, as stated above, 375 millim., but Russell records one of 510, and Rüppell states that it grows to 760. Commerçon's specimen, which formed the type of *Casiomorus blochii* Lacépède, was a little over 450 millim. and weighed 3 lb., but he remarked that it attained twice that size.

Illustration:—Our figure is taken from the Raine Island fish, and is on exhibition in the show-cases of the Queensland Museum, Reg. No. I. 14/1912.

PART VII.—LETHRINIDÆ (No. 1).

FAMILY LETHRINIDÆ.

Lethrinidæ Regan, Ann. & Mag. Nat. Hist. (8) xii, July 1913, p. 123.

THE WHIPTAIL, OX-EYE, AND EMPEROR BREAMS.

Body compressed, covered with moderate or rather small, adherent, ciliated scales. Lateral line complete, not extending on the caudal fin, the tubes bifid or simple, not reaching the border of the scale. Head partially scaly, with moderate or long, pointed snout. Mouth terminal, protractile, with moderate, oblique cleft. Jaws anteriorly with rows of villiform teeth, preceded by canines; laterally with a single series of stout teeth, which may be conical or obtuse; roof of mouth and tongue toothless. One dorsal fin, with 10 heteracanthous spines, the spinous portion much longer than the soft and depressible in a groove. Caudal fin more or less deeply emarginate, with 17 principal rays, 15 of which are branched. Anal fin short. Pectorals pointed. Ventrals thoracic, approximate, pointed, with 15 rays, inserted behind or below the pectoral-base; accessory scale present. Gill-openings wide; gill-membranes united, free from the isthmus; six branchiostegals; pseudobranchiæ present; gills four, a slit behind the fourth; gill-rakers mostly reduced to a few spinulose prominences; pharyngeal bones separate. Air-bladder present. Stomach cæcal; pyloric appendages in small number; intestinal canal short. Vertebrae 24 (10+14).

³² This specimen was purchased in the Brisbane market by Mr. Vincent Jeff, a fishmonger of long standing and wide experience, who kindly presented it to me. That he had never before seen anything like it proves its great rarity in our southern waters.

Regan supplies the following skeletal characters—"Premaxillaries with rather long pedicels and short rami; the latter without posterior expansions or processes, and with their distal ends internal to the maxillaries. Occipital crest strong; parietal crests moderate or strong. All the precaudals with parapophyses, all the ribs, or all but the first, inserted on the parapophyses."

Regan further subdivides the family in two groups, based upon the following cranial characters—

"Subocular shelf small, emitted by the second suborbital but mainly internal to the first; maxillary with a very broad posterior expansion below its articulation with the palatine; maxillary process of palatine normal; outer face of palatine with a prominent ridge which extends on to the pterygoid" PENTAPUS, SPHERODON.

"Subocular shelf vestigial, a minute process of the second suborbital at its junction with the first; maxillary with a moderately broad posterior expansion, which is overlapped by a flattish downwardly curved branch of the maxillary process of the palatine; outer face of palatine without ridge" LETHRINUS.

A small and compact family of percoidean fishes of moderate size, closely allied to the *Lutjanida*, containing some of our finest food-fishes, and inhabiting chiefly the inshore waters of the Indian and Western Pacific Oceans; one species ranging eastward to the Hawaiian Islands, another from the West Coast of Africa. Three genera¹ with numerous species recognised.

Synopsis of lethrinoid Genera.

*a*¹. Cheeks scaly; maxillary exposed distally.

*b*¹. Upper surface of head scaly; eye moderate; opercle with a pungent spine; lateral jaw-teeth conical i. PENTAPUS.

*b*². Upper surface of head naked; eye very large; opercle without pungent spine; lateral teeth molariform ii. MONOTAXIS.²

*a*². Cheeks and upper surface of head naked; maxillary concealed; eye moderate; opercle without true spines iii. LETHRINUS.

Note.—The genus *Monotaxis* has not as yet been recorded from Queensland waters, but it has a wide range from the Red Sea on the west to Hawaii on the east, and is a common fish among both the Malayan and the South Sea Islands; it has also been recorded from "New Holland" by Kner and from the Engineer Group off the south-east of Papua by Macleay. It is, therefore, only a matter of time until its occurrence on our shores be made known. The enormous eye, which is persistent through life, should attract collectors, while the young or half-grown fish, with its two broad white cross-bands on an olive green or roseate ground, forms so striking an object that its presence in our northern waters should be easily ascertainable.

PENTAPUS Cuvier and Valenciennes.

Pentapus Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 1830, p. 258 (*vittatus*); Günther, Brit. Mus. Catal. Fish., i, 1859, p. 380; Day, Fish. India, pt. i, 1875, p. 93; Bleeker, Atlas Ichth., viii, pt. 2, 1877, p. 100.

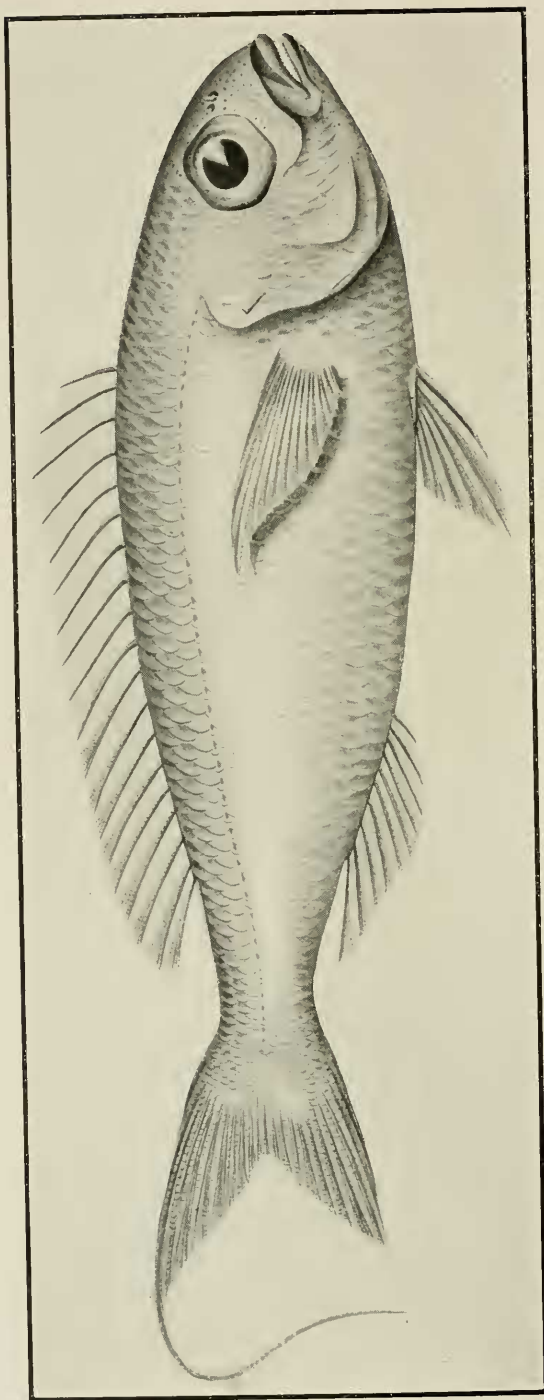
Leiops Bennett, in Life of Raffles, 1830, p. 688.

Gnathodentex Bleeker, Versl. Akad. Amsterdam (2) vii, 1873, p. 41 (*aurolineatus*).

¹ I can not admit the validity of Fowler's genus *Lethrinella*, because I have no specimens of *L. miniatus* on which to form a judgment, and because I have not had an opportunity of consulting the paper in which it is described, and which is not, so far as I know, to be found in Australian libraries. With regard to *Neolethrinus* Castelnau (Res. Fish. Austr., 1875, p. 11), if the author's description be correct, it can not belong to this family.

² *Monotaxis* Bennett, Life of Raffles, 1830, p. 683 (*indica*=*grandoculis*).

Sphærodon Rüppell, Neue Wirbelth. Abyss., Fisch., 1837, p. 112 (*grandoculis*).



PENTAPUS AURIFILUM Ogilby. ♂ Nat. Size.

Phyllis Clarke, del.

Body elliptical, compressed. Scales moderate, adherent, etenoid. Lateral line tubes bifid, extending over the entire exposed surface of the scale. Head moderate, with rather long pointed snout and narrow deeply cleft preorbital; scaly, except on the snout, preorbital, and suborbital; preopercle more or less naked; cheek-scales in more than three series. Cleft of mouth moderate and a little oblique, the jaws equal; maxillary exposed posteriorly. Jaws with bands of villiform teeth and two or three pair of small anterior canines. Eye moderate. Opercle with a small spine. Dorsal fin with x 8 to 10 rays, the spinous portion much longer than the soft, naked, and depressible in a groove. Caudal deeply emarginate, one or both lobes sometimes produced in a filament. Anal similar to the dorsal, with iii 7 to 10 rays, the 3rd spine longest. Pectoral short and pointed, with 14 to 16 rays. Ventral inserted behind the pectoral-base; accessory scale present.

Fishes of rather small size, inhabiting the warmer parts of the Indian and Western Pacific Oceans.

PENTAPUS AURIFILUM Ogilby.

Pentapus aurifilum Ogilby, New Fish. Queensl. Coast, 20 Dec. 1910, p. 93.

YELLOWLIP.

(Plate XX.)

Type locality:—North Reef.

Body elliptical, the ventral profile more arched than the dorsal, its width 1.84 in its depth, which is 3 to 3.45 in its length and subequal to the length of the head. Caudal peduncle twice as long as deep, its least depth 10 to 11.25 in the length of the body. Head about one third longer than deep, its upper profile level from above the anterior border of the eye, its width 1.66 in its length, which is 3.33 to 3.6 in that of the body. Snout rather short, with evenly convex profile, its length 3.15 to 3.33 in the length of the head. Eye rather large, its diameter a little more than the length of the snout and 2.6 to 3 in the length of the head. Interorbital region feebly convex, its width 1.3 to 1.4 in the eye-diameter. Jaws equal; maxillary extending to below or slightly beyond the anterior border of the eye, its length 2.9, that of the mandible 2.33 in the length of the head. Preopercle entire or feebly crenulate, naked; opercle with a small sharp spine.

Upper jaw with three pair of small canines, the outer the largest; mandibular canines vestigial.

Scales in 49 to 51 transverse series, in 3/1/10 in the series running obliquely backwards from the origin of the dorsal fin.

Cheek-scales in 3 series; preopercle naked; occipital scales extending forwards to form a convex border between the posterior margins of the pupils.

Dorsal fin with x 9 rays, the soft portion about two thirds of the length of the spinous; 5th spine longest, a little shorter than the anterior rays and 2.15 to 2.33 in the length of the head. Middle caudal rays about 2.25 in the upper lobe, without the filament, which is 4.5 in the body-length; 2nd ray of upper lobe produced in a long slender filament. Anal fin originating below the 2nd dorsal ray, with iii 7 rays, the spines evenly graded, the last one third of the length of the head and a little shorter than the 1st ray; last ray somewhat produced, longer than the 1st. Pectoral fin with 16 rays, its length 3.75 to 4 in that of the

body. 5th ray longest, not or just reaching the vertical from the vent. Ventral fin 1.5 in the length of the pectoral and 1.4 in that of the head, the outer ray the longest, extending not quite to, to, or a little beyond the vent.

Gill-rakers 4 or 5 + 8 or 9, short and claviform, the shortest 6 to 6.67 in the eye-diameter.

Upper surface red, gradually shading through the rose-pink of the sides to the pearly white of the belly; a yellow lateral band from the opercle to the upper caudal lobe, and a pair of similar bands, united anteriorly, from the isthmus to the lower caudal lobe, passing just outside the bases of the ventral and anal fins. Upper lip saffron-yellow. Dorsal, anal, pectoral, and ventral fins hyaline, the first tipped with gold; caudal pink, with a wide greenish yellow terminal border and the filamentous ray brilliant sulphur yellow. (*aurum*, gold; *filum*, a thread or filament.)

Described from 5 examples, measuring from 195 to 298 millim., taken on the Queensland Coast between Cape Moreton and Edgcumbe Bay, at depths varying from 13 to 70 fathoms.

Nothing is known of this beautiful species save such statistics of distribution as were collected on board the "Endeavour." The total number of specimens trawled was 840, to which must be added a single example taken by hook off Cook Island, Byron Bay, the most southern point where it was found. Appended is a summary of the Queensland localities at which it was obtained with particulars of soundings, etc.

"Cape Moreton, N. 53° W., 5 miles; 51 fath., dark sand and shell, 2 examples. Cartwright Point, S. 18° W., 11 miles; 24 fath., fine sand, 20. Low Bluff, S. 10° E., 6 miles; 15 fath., fine sand, 18. Double Island Point, N. 30 W., 19 miles; 33 fath., fine dark sand, 52. Double Island Point, N. 42° W., 3.5 miles; 33 fath., fine dark sand, 1. North Reef, N.E. ½° E., 13 miles; 70 fath., fine sand and shell, 66. Cape Capricorn, S.E., 14 miles; 13 fath., ?, 1. Hummocky Island, S. 7° E., 7 miles; 15 fath., sand and shell, 2. Pine Peak, S. 58° E., 14 miles; 25 fath., mud, 367. Cape Gloucester, S. 62° W., 21 miles; 36 fath., sand and mud, 305. Cape Gloucester, S. 13° E., 5.5 miles; 25 fath., mud, 5. Bowen Light, S. 22° W., 7 miles; 14 fath., sand and mud, 1."

If trawling should become general on the Queensland Coast this species is likely to become a favorite breakfast fish, supplemental to the whittings and other fishes of similar size.

LETHRINUS Cuvier.

Lethrinus Cuvier, Règne Anim., ed. 2, 182 (*chærorhynchus*); Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 1830, p. 272; Günther, Brit. Mus. Catal. Fish., i, 1859, p. 453; Day, Fish. India, pt. 1, 1875, p. 134; Bleeker, Atlas Ichth., viii, pt. 2, 1877, p. 110; Jordan & Thompson, Proc. U. S. Nat. Mus., xli, 1912, p. 558.

Lethrinella Fowler.

Lethrinichthys (subgenus of *Lethrinus*) Jordan & Thompson, *ibid.* (*nematacanthus*).

Body ovate to subovate, compressed. Scales moderate, adherent, finely ciliated. Lateral line tubes simple and straight, extending over the basal half of the scale only. Head large, with long pointed snout and wide preorbital, naked except the opercle, subopercle, and a part of the postorbital and parietal regions. Cleft of mouth moderate and oblique, the jaws equal; maxillary concealed. Jaws anteriorly with two or three pairs of caninoid teeth, behind which are several series of small sharp cardiform teeth; lateral teeth strong, in a single series. Eye

moderate. Opercle with two blunt points, the upper little prominent. Dorsal with x 9 rays, the spinous portion much longer than the soft, depressible in a scaly sheath. Caudal emarginate. Anal with iii 8 rays, the spines strong. Pectoral long and pointed, with 13 rays, the 2 upper simple. Ventral inserted below or a little behind the pectoral-base; accessory scale present.

Fishes of moderate size, inhabiting the warmer zones of the Indian and Western Pacific Oceans; one species from the West Coast of Africa. A large number of species—about 90—have been described by various authors, but only about one third of these are sufficiently characterized. Of the irre recognizable remainder Valenciennes is responsible for fully half, but of these Sauvage claims to have rediscovered nine, namely—*L. frenatus*, *L. semicinctus*, *L. olivaceus*, *L. borbonicus*—and Steindachner one—*L. genivittatus*—but the works in which these authors redescribe the species are not available to me.³ Two of the remaining species—*L. cyanoxanthus* and *L. cinnabarinus*—are figured by Richardson in the *Icones Piscium*, 1843, pl. iv, figs 1 & 2, as coming from Australia, but they have not since been recognized.

Owing to the many characters which, in most fishes differential, are common to all the members of this genus, the difficulty of distinguishing between the species is greatly increased. On this subject Bleeker pertinently remarks⁴:—

“The species of the genus are numerous but rather difficult to define satisfactorily. They resemble one another in the formula of the spines and rays, in the number of the scales on the lateral line varying only between 45 and 50, in the lepidosis of the head, etc. We have attempted to find specific characters in the length of the snout, in the relative height of the preorbital, and in the form of the posterior jaw-teeth; but these characters have only a proportional value, since the snout becomes longer with the age of the individual, the height of the preorbital increases from the young to the adult state, and the lateral teeth of the jaws, obtuse or rounded and molariform in old examples, are frequently conical and pointed in the young of the same species. Nor do we find more distinctive characters in the coloration. The large blackish lateral spot, thought to be characteristic of certain species, is often present in immature individuals only and usually disappears with advancing age. The body-colors, vivid in the young and often variegated with bands, bars, ocelli, and spots, become more or less uniform in the adult, and commonly disappear in such as are preserved for a length of time in liquor. The most distinctive characters may be found in the number of longitudinal series of scales above the lateral line, in the shape of the profile, in the relative heights of the body and head [as compared with their respective lengths], in the strength and relative length of the dorsal spines, and in the height of the anal [as compared with its length].”

LETHRINUS NEBULOSUS (Forsk.)

Sciæna nebulosa Forskal, Deser. Anim., 1775, p. 52; Bonnaterre, Encycl. Méth., Ichth., 1788, p. 124 (after Forskal).

³ Sauvage, in Grandidier's History of Madagascar, vol. xvi, 1891, and Steindachner, Verh. Zool.-bot. Ges. Wien., 1866, p. 478.

⁴ Atlas Ichth., viii, p. 110.